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ZOOLOGY

Vol. 2, No. 4, pp. 113-233, Figs. 1-62, October 14, 1905

CONTRIBUTIONS FROM THE LABORATORY
OF THE
MARINE BIOLOGICAL ASSOCIATION OF SAN DIEGO

IV

THE PELAGIC COPEPODA OF THE SAN DIEGO REGION

BY

C. O. ESTERLY

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IV.

THE PELAGIC COPEPODA OF THE SAN DIEGO REGION.

BY

C. O. ESTERLY.

The present paper is the result of a study of the pelagic Copepoda collected in the San Diego region during one month of the summer of 1903, nearly two months of 1904, and during December and January, 1903. Likewise, there have also been examined a few collections taken during the fall of 1904. Such time as has been spent on the subject serves to convince the writer that a good deal of further study is necessary, and that, taking the field as a whole, this report is incomplete. Such forms as are described here seem well established. Without doubt there are others which are new, but for lack of proper material they are not now dealt with.

The work was commenced at the San Diego Marine Laboratory connected with the University of California, and completed at Harvard University. It is a pleasure to express my appreciation of the helpful suggestions and advice of Professor W. E. Ritter of the University of California, and Professor E. L. Mark of Harvard University.

In the body of a free-swimming Copepod two regions are readily distinguishable, a cephalothorax and an abdomen. In the first suborder, *Gymnoplea*, the cephalothorax consists of the head and five thoracic segments, though the head is often fused with the first thoracic segment, and the fourth with the fifth. In the second suborder, *Podoplea*, the last thoracic segment is drawn into the abdominal portion; this, then, loosely speaking, contains one thoracic segment.

In typical groups the abdomen proper consists of five segments in the male, and always less than five in the female; fusions often reduce the number of segments to as few as one or two. The first segment of the abdomen in each sex bears the orifices of the sexual organs, and is called the *genital segment;* the last segment contains the opening of the alimentary canal, and is called the *anal segment.* The *furca* is a paired appendage, borne on the anal segment and carrying usually a fringe of six bristles of various lengths. The anterior portion of the head segment is known as the *front,* and terminates ventrally in the *rostrum.* The latter may consist of one or two strong, pointed projections, or of the same number of long, slender filaments.

The appendages of the cephalic segments in order are, from front to rear: (1) The *anterior antennae;* (2) The *posterior antennae;* (3) The *mandibles;* (4) The *maxillae;* (5) The *anterior maxillipeds* (second maxillae); (6) The *posterior maxillipeds* (maxillipeds). The thoracic segments bear the swimming feet (four pairs), and also a fifth pair of feet which usually are modified in both sexes, and at times are absent in the female. The cephalic appendages from 3 to 6, inclusive, are the mouth parts. All the appendages except the anterior antennae are typically biramous: each consists of a two-jointed basal part (*basipodite*), which bears the inner and outer rami (respectively *endopodite* and *exopodite*). Neither ramus is more than three-jointed, and in many forms the number of joints is reduced by fusions.

The anterior antennae in the *Gymnoplea* consist of 25 joints, but this number may be reduced by fusion. The joints carry bristles and sense organs, or *aesthetasks.* The joints in an appendage, or a part of one, are numbered from the base to the tip. Among the *Gymnoplea* one of the anterior antennae of the male may be modified to form a grasping organ; this is usually on the right side, but both appendages may be so modified. The grasping organ may be recognized by its want of symmetry. The joints on either side of the geniculation are often provided with teeth. In many of the *Gymnoplea* the fifth feet in the male form grasping organs; the fifth feet are always asymmetrical in the male, whether they form grasping organs

or not. In the *Podoplea* some of the males have anterior grasping antennae; in others this function is performed by the posterior antennae or posterior maxillipeds.

The main axis of the appendages (excepting the anterior antennae) may be considered as parallel to the dorso-ventral diameter of the animal; accordingly anterior and posterior faces are distinguished in an appendage as well as proximal and distal portions, and inner or outer margins of the various joints. This nomenclature is useful, especially since most appendages are flattened. The form, arrangement and number of the bristles on the appendages are used a great deal in identification, and for that reason the appendages must usually be dissected off.

It is of importance to have only adult animals for study. The adult male in most genera has noticeable sexual peculiarities in the structure of the fifth feet or in the grasping antenna. The females are certainly adult if carrying eggs or spermatophores. In large animals it is a comparatively easy task to dissect off the appendages, but in the majority of the *Podoplea* and the smaller *Gymnoplea* it requires a good deal of patience and a steady hand. A dissecting microscope is indispensable, and it is a good plan to use fine needles, which may be ground down to an edge. Farrant's fluid makes a good mounting medium for permanent preparations. If it is spread thin over the slide the appendages may be placed in order in it and the cover glass put on without disturbing the arrangement. For the determination of the genus of an individual the feet especially must be removed and examined.

Most of the drawings in this paper were made with the aid of the Abbé camera. The keys, and descriptions of all but new species, are translated from Giesbrecht's works of 1892 and 1898. In the general key for the *Gymnoplea* the plan adopted in the Tierreich (1898) has been followed, but only those genera are included which from their distribution might be expected to occur in the San Diego region. Species keys are given in some cases, but include only the species actually found; however, if one sex of a form occurs, and the other has not been obtained, a description of the latter is given in most cases.

It may be remarked that little defense is needed for translating bodily from Giesbrecht, in view of the fact that whatever could be written concerning any form known to him has been so well stated that one could not improve upon it.

Following is a list of the species treated in this paper:

GYMNOPLEA.	PAGE
1. *Acartia tonsa* Dana	204
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3. *Arietellus setosus* Giesbrecht	189
4. *Augaptilus longicaudatus* Giesbrecht	188
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8. *Calanus robustior* Giesbrecht	129
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22. *Euchaeta spinosa* Giesbrecht	159
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32. *Heterorhabdus spinifrons* Claus	182
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41. *Pleuromamma gracilis* Claus 175
42. *Pleuromamma xiphias* Giesbrecht 176
43. *Rhincalanus nasutus* Giesbrecht 136
44. *Scolecithrix bradyi* Giesbrecht 165
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46. *Scolecithrix pacifica,* new species 168
47. *Scolecithrix persecans* Giesbrecht 166
48. *Scolecithrix similis* Scott 170
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51. *Undeuchaeta minor* Giesbrecht 149

PODOPLEA.

52. *Clytemnestra rostrata* Giesbrecht 214
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56. *Microsetella rosea* Giesbrecht 211
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59. *Oncaea conifera* Giesbrecht 216
60. *Oncaea minuta* Giesbrecht 217
61. *Sapphirina angusta* Dana 221
62. *Sapphirina iris* Dana 219
63. *Sapphirina lomae,* new species 223
64. *Sapphirina scarlata* Giesbrecht 222

I Sub-order.—GYMNOPLEA.

Gymnoplea (sub-order) Giesbrecht, 1892, p. 41.
Gymnoplea (tribe) Giesbrecht, 1898, p. 7.

The genital orifices lie in the first segment of the posterior division of the body; they are ventral and paired in the female, unpaired and lateral in the male. The fifth pair of feet in the female are like the preceding pairs, retrograded or lacking; in the male a pairing organ always present. The first segment of the posterior division of the body (abdomen) never bears appendages. The abdomen of the male is 5 segmented (fig. 3*a*), and the female seldom carries the eggs in sacks hanging from the genital orifice. The anterior antennae in the male may be symmetrical, or one may form a grasping organ; in the female the antennae are symmetrical.

KEY TO THE GENERA OF THE GYMNOPLEA.

(The genera marked with an asterisk have been found in the San Diego region.)

1. Inner ramus of third and fourth feet 3-jointed, figs. 12*a*, 19*b*..... 2
1. Inner ramus of third and fourth feet 2-jointed, fig. 44*d*..... 19
2. Inner ramus of first foot 3-jointed..... 3
2. Inner ramus of first foot 2-jointed..... 32
2. Inner ramus of first foot 1-jointed, fig. 15*d* 38
3. A black or brown knob on the first segment of the cephalothorax in the antero-lateral angle, on the right or left side; figs. 33*a*, 34*a* ..... ***Pleuromamma**
3. This knob absent 4
4. First joint of inner ramus of second foot with proximally curved hooks on the inner margin; fig. 35*b*.....***Metridia**
4. This joint, like the rest, bearing a bristle..... 5
5. Terminal joint of outer ramus of third and fourth feet with two spines or thorns on outer margin, and one terminal bristle; fig. 1*d* 6
5. Terminal joint as above, but with three spines on outer border; figs. 17*b*, 19*b* 6*a*
6. Terminal bristle of outer ramus of third and fourth feet with broad, smooth border; fig. 1*d* .....***Calanus**
6*a*. Terminal bristle bearing teeth or spines on outer border; figs. 35*a*, 39*a* 7
7. One bristle of left ramus of furca much longer and thicker than the other furcal bristles 8
7. Furcal bristles symmetrical 9
8. Mandibular blade with three or four teeth, the ventral one hooked and separated from the others by a wide space; fig. 38*f* ..... ***Heterorhabdus**
8. Mandibular blade with at least 8 teeth.....**Disseta**
9. Anterior antennae symmetrical 10
9. Anterior antennae asymmetrical 14
10. Rami of fifth feet 3-jointed; fig 32*c*..... 11
10. Rami of fifth feet 2-jointed.....***Augaptilus**♀
10. Outer ramus 3-jointed, inner ramus 2-jointed.....**Isochaeta**♀
10. Outer ramus 3-jointed, inner ramus 1-jointed.....**Isias**♀
10. Outer ramus 3-jointed, inner ramus lacking.....***Phyllopus**♀
10. Outer ramus 1-jointed, inner ramus rudimentary; fig. 42*b* ***Arietellus**♀
11. Middle joint of outer ramus of fifth foot with a thorn-like process which is fused with the joint; fig 32*c*.....***Centropages**♀
11. This joint with an awl-shaped or rudimentary bristle on the inner border; figs. 36*b*, 38*e* 12
12. Terminal joint of inner ramus of fifth foot with five bristles; fig. 36*b* ..... ***Lucicutia**♀
12. This joint with at least six bristles..... 13
13. Abdomen with 4 segments ..... **Haloptilus**♀
13. Abdomen with 3 segments .....***Augaptilus**♀

14. Grasping antenna on right side 15
14. Grasping antenna on left side 17
15. Inner rami of both feet of fifth pair 3-jointed, with plumose bristles; fig. 40*a* 16
15. Inner rami rudimentary, without plumose bristles .....**Isias**♂
16. Inner rami of feet of fifth pair unlike, the right foot with a forceps ..... ***Centropages**♂
16. Inner rami alike; figs 41*c*, 41*d*.....***Augaptilus**♂
17. Both rami of each foot of fifth pair 3-jointed..... 18
17. Both outer rami 3-jointed, the inner rudimentary.....***Arietellus**♂
17. Rami of left fifth foot 3-jointed, of the right 2-jointed.. ***Lucicutia**♂
18. Inner ramus of maxilla present, distal bristles of anterior maxilliped naked or set with spines.....**Haloptilus**♂
18. Inner ramus of maxilla lacking; distal bristles of anterior maxilliped with mushroom-shaped appendages (cf. fig. 41*b*) ..... ***Augaptilus**♂
19. Inner ramus of first foot 3-jointed..... 20
19. Inner ramus of first foot 2-jointed 25
19. Inner ramus of first foot 1-jointed .....**Eurytemora**
20. Head without dorsal cuticular lenses or lateral hooks..... 21
20. Head with one or two pairs of cuticular lenses and hooks on each side 23
21. Rami of posterior antennae about equal in length.....**Parapontella**
21. Inner ramus much the shorter 22
22. Abdomen with asymmetrical outgrowths .....**Pontellopsis**
22. Abdomen symmetrical .....**Pontellina**
23. Head with two pairs of eye lenses.....**Anomalocera**
23. Head with but one pair of lenses 24
24. Last two thoracic segments distinct; anterior antennae of female 24-jointed; terminal portion of grasping antennae of male 4-jointed ..... **Pontella**
24. Last two thoracic segments fused; anterior antennae of female 22-jointed; terminal portion of grasping antennae of male 4-jointed ..... **Ivellopsis**
25. Head with one pair of cuticular lenses; fig. 48*a*.....***Labidocera**
25. Head without dorsal cuticular lenses 26
26. Inner rami of fifth feet jointed.....***Centropages**
26. Inner rami of fifth feet 1-jointed or absent..... 27
27. Second maxilliped longer than the first 28
27. Second maxilliped shorter than the first 29
28. Furca long and narrow, at least six times as long as broad....**Temora**
29. First joint of maxillipeds with few short bristles; fig. 47*h*..***Candacia**
29. This joint bearing long bristles set with spines..... 30
30. Outer ramus of posterior antennae less than half as long as the inner ramus .....***Acartia**
30. Outer ramus more than half as long as the inner..... 31
31. Posterior maxilliped 6- 7- jointed.....**Calanopia**
31. Posterior maxilliped 3-jointed .....**Tortanus**
32. Both feet of fifth pair with inner rami, which are 2- or 3- jointed, bristles plumose .....***Lucicutia**

32. Inner rami without plumose bristles, or lacking; the entire foot may be absent on one or both sides..... 33
33. Furca long and narrow, at least six times as long as broad....**Temora**
33. Furca at most three times as long as broad..... 34
34. Middle joint of outer ramus of third and fourth feet with two bristles; terminal joint with seven; fig. 12*a*..... 35
34. Middle joint with one, terminal with five..... 37
35. Outer border of outer ramus of swimming feet not denticulate.. ..... **Calocalanus**
35. Outer border on rear pairs denticulate; fig. 12*a*..... 36
36. Fifth foot lacking in female, or knob-like; in the male only the left fifth foot present .....**Acrocalanus**
36. Fifth foot in female 2-jointed (fig. 12*c*); in the male the right is 2-jointed, the left 5-jointed (fig. 12*e*).....***Paracalanus**
37. Outer ramus of first foot 3-jointed; fifth foot absent in female... ..... ***Eucalanus**
37. Outer ramus of first foot 2-jointed; fifth foot present in female (fig. 10*b*) .....***Rhincalanus**
38. Inner ramus of second foot 3-jointed.....***Mecynocera**
38. Inner ramus of second foot 2-jointed (fig. 28*b*)..... 39
38. Inner ramus of second foot 1-jointed (fig. 25*e*) 51
39. Terminal joint of outer rami of second to fourth feet with five bristles on inner margin .....**Spinocalanus**
39. Terminal joint with four bristles on inner margin (fig. 14*b*)..... 40
40. Surfaces of rami of second to fourth feet without very large spines; appendages of anterior maxillipeds have the form of bristles or hooks 41
40. Surfaces of outer rami and of the two terminal joints of the inner rami of the third and fourth feet with larger spines (as in fig. 28*b*); part of the appendages of the anterior maxilliped vermiform (fig. 30*d*) or pencillate 49
41. Basals and outer rami in second and third feet broader than in the fourth pair, the second basal irregularly toothed on the distal border (fig. 13*b*)..... ***Clausocalanus**
41. Second and third feet not differing as above from fourth foot... 42
42. Outer marginal thorns of terminal joint of outer ramus of third and fourth feet comb-like and placed in deep indentations in the margin .....**Ctenocalanus**
42. These of the usual shape 43
43. Fifth pair of feet symmetrical or lacking..... 44
43. Fifth pair of feet asymmetrical or lacking 47
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44. Head without this spine 45
45. Fifth foot lacking .....**Pseudocalanus**♀
45. Fifth foot 2-jointed, with a thick, curved bristle at the end..... 46
46. Terminal bristle of fifth foot much longer than the basal joint ..... **Drepanopus**♀
46. Terminal bristles not as long as, or but little longer, than basal joint ..... **Stephus**♀

47. Fifth feet, especially the left, with several apical appendages... ..... **Stephus**♂
47. Fifth feet slender, stylet-like, with a few short needles or with but one needle or hook-like appendage..... 48
48. Fifth feet slender, stylet-shaped, about as long as the abdomen... ..... **Pseudocalanus**♂
48. These shorter than the abdomen, the right foot with a terminal hook ..... **Drepanopus**♂
49. Cephalothorax broad to globular ..... **Phaenna**
49. Cephalothorax elongate, ellipsoidal (figs. 26*a*, 29)..... 50
50. Head distinct from thorax ..... **Xanthocalanus**
50. Head fused with thorax (figs. 26*a*, 27)..... ***Scolecithrix**
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51. Fifth foot present 59
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52. Lateral angles of last thoracic segment rounded or slightly pointed (figs. 16*a*, 19*a*) 56
53. Bristles of the sixth joint from the last in the anterior antennae thick and transversely ringed ..... **Bradyidius**♀
53. These bristles of the usual form 54
54. Rostrum with two heavy teeth (fig. 14*a*)..... ***Aetideus**♀
54. Rostrum with one point (fig. 15*b*) or lacking..... 55
55. Outer ramus of first foot 3-jointed ..... **Chiridius**♀
55. Outer ramus of first foot 2-jointed (fig. 15*d*)..... ***Gaidius**♀
56. Rami of posterior antennae about equal in length..... ***Euchaeta**♀
56. Outer ramus at least 1½ times as long as the inner ramus (fig. 20*c*) 57
57. Inner border of first basal of fourth foot naked or feathered..... 58
57. Inner border with teeth or spines (figs. 19*b*, 20*d*)..... ***Euchirella**♀
58. Head with or without crest (figs. 16*a*, 17*a*); last thoracic segment not produced into spines or blunt processes..... ***Undeuchaeta**♀
58. Head with median crest, last thoracic segment produced into blunt processes (not spines) ..... **Chirundina**♀
59. Last thoracic segment on each side with a strong point (fig. 14*a*) ..... ***Aetidius**♂
59. Last thoracic segment rounded (fig. 20*a*)..... 60
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60. Right fifth foot ends in a stylet without forceps (fig. 23*a*).... 61
61. Inner rami of posterior antennae at most equal in length to the outer ..... **Euchaeta**♂
61. Inner rami of posterior antennae over half the length of the outer ..... ***Undeuchaeta**♂

Fam. CALANIDAE.

Dana (subfamily), 1852.
Claus, 1863, p. 166.
Giesbrecht, 1892, p. 41; 1898, p. 12.

First antennae of male symmetrical or nearly so, not geniculate; aesthetasks more numerous than in female. Fifth feet of female either like the preceding ones or in various stages of degeneration, often resulting in complete loss. The males vary from the females in the segmentation and form of abdomen, in structure, number of joints, and appendages of the anterior antennae, and in the form of the fifth foot. Head usually distinct from thorax; the two last thoracic segments usually fused. Rostrum with one or two joints, sometimes lacking. Abdomen of female usually with 4 (fig. 1*a*), seldom with 3 or 2 segments; that of the male with 5, often with very short anal segment. Anterior antennae of female, 16- to 25-jointed. Outer ramus of second antennae one-half to four times as long as the inner, 5- to 8-jointed, middle joints short, end ones usually elongate. Six to eight teeth on blade of mandible, outer ramus 5-, inner ramus 2-jointed. Maxilla with at least two lobes on inner margin and one on outer; outer ramus always present, inner 1- to 3-jointed, seldom fused with second basal. Proximal and distal curved bristles of first maxilliped usually equal in length, the former sometimes modified into delicate saclike appendages (fig. 30*b*). Second maxilliped elongate, terminal portion (inner ramus) 5-jointed, from one-third to one and one-half times the length of the second basal. Outer rami of first to fourth feet 3-jointed (that of first foot occasionally 2-jointed); inner ramus of first and second pairs 1- to 3-jointed, of third and fourth 3-jointed; terminal bristle of outer rami at times with smooth border (fig. 1*d*), not serrate. Inner rami of fifth pair of male rarely 3-jointed, mostly rudimentary or lacking; the outer ramus forms hooks or shears; occasionally the entire appendage of one side may be absent.

Sub-fam. Calaninae.

Calanina Giesbrecht, 1892, p. 44.

Fifth pair of feet in the female in all respects like the preceding pairs; in both sexes all five pairs are provided with 3-

jointed inner and outer rami, and the number of outer marginal bristles on the outer ramus is the same in all the feet. The number of bristles on the inner ramus of the first pair is: one on the first joint, two on the second, six on the third (one on outer margin); on the terminal joint of the second and third pairs there are eight (two outer marginals). The fifth pair of feet in the male is always modified to form an accessory sexual organ: the right foot has a 2-jointed basal and is biramous, each ramus with three joints; the left foot has also a 2-jointed basal, and a 3-jointed outer ramus, while the inner ramus is reduced and may be entirely absent.

1. Genus **Calanus** Leach.

Monoculus Gunner, 1765.
Calanus Leach, 1819, p. 539.
Undina Dana, 1852, p. 1047.
Cetochilus Claus, 1863, p. 169.
Calanus Brady, 1883, p. 30.
Calanoides Brady, 1883, p. 74.
Undina Brady, 1883, p. 52.
Calanus Giesbrecht, 1892, pp. 45, 88, 725.
Calanus Dahl, 1894*b*, p. 61.
Calanus Dahl, 1898, p. 13.
Calanus Wheeler, 1899, p. 164.

♀ Head free, or fused with thorax; fourth and fifth thoracic segments not fused. Abdomen with 4 segments, genital segment symmetrical, furca occasionally asymmetrical. Anterior antennae 25-jointed, terminal joints with long, plumose bristles; the antennae vary in length, in some cases not reaching the posterior end of the body, in others extending beyond the furca (fig. 5*a*). Rami of posterior antennae of about equal lengths, outer ramus 7-jointed. Inner ramus of maxilla 3-jointed. Anterior maxilliped with long, curved bristles on inner border, outer border with a plumose bristle. Inner ramus of posterior maxilliped long, 5-jointed, bristles long and stiff, usually not plumose. Outer and inner rami of first to fourth pairs of feet 3-jointed, first, second and third joints of outer rami of all with 1, 1, 2 marginal spines, respectively, terminal bristle scalpelliform, its margin smooth (fig. 1*d*). Inner ramus of first foot with 1, 2, 6 bristles on the first, second and third joints in order; terminal

joint of inner ramus of second and third feet with eight bristles. Fifth foot like the others.

♂ Abdomen with 5 segments, genital orifice on left side of genital segment. Number of joints in the anterior antennae reduced, at least by fusion of the first and second joints. Mouth parts often retrograded; swimming feet usually as in the female. Fifth feet in some cases similar to the swimming feet, in others asymmetrical pairing organs (fig. 1*b*, *c*), 2 basals on each side, right foot (fig. 1*b*) with 3-jointed outer and inner rami, the left (fig. 1*c*) with 3-jointed outer ramus without plumose bristles, inner ramus reduced or lacking.

KEY TO THE SPECIES.

♀1. Anterior antennae extend beyond end of cephalothorax for at least half its length (fig. 5*a*) 2
1. Anterior antennae do not extend beyond end of cephalothorax, or only for a few joints at most 4
2. Bristles of furca symmetrical ..... **C. tenuicornis**
2. Furca with an elongated bristle on left side 3
3. Ventral surface of genital segment very strongly convex (fig. 5*c*) ..... **C. robustior**
3. Ventral surface of genital segment rather slightly convex (fig. 4*a*) ..... **C. gracilis**
4. Head not fused with thorax: cephalothorax with six segments (fig 1*a*) ..... **C. finmarchicus**
4. Head fused with thorax: cephalothorax with five segments (fig. 2) ..... **C. minor**

♂1. Anterior antennae longer than body by at least six joints ..... **C. tenuicornis**
1. Anterior antennae not longer than body, or but slightly so 2
2. Outer margin of terminal joint of outer ramus of second to fourth feet denticulate 3
2. Outer margin of same smooth or feathered 4
3. Inner rami of fifth feet similar in structure ..... **C. gracilis**
3. Inner ramus of left foot of fifth pair shortened and without bristles ..... **C. robustior**
4. Outer ramus of right fifth foot with plumose bristles on inner margin ..... **C. minor**
4. Outer ramus of right fifth foot without bristles on inner margin (fig. 1*b*); outer ramus of left foot (fig. 1*c*) less than twice as long as that of the right ..... **C. finmarchicus**

1. **Calanus finmarchicus** Gunner.

Monoculus finmarchicus Gunner, 1765, p. 175, figs. 20-30.
Calanus perspicax Dana, 1852, p. 1071; 1855, pl. 74, figs. 1*a-c*.
Cetochilus helgolandicus Claus, 1863, p. 171, pl. 26, figs. 2-9.
Calanus finmarchicus Brady, 1883, p. 32, pl. 1, figs. 1-10.
Calanus finmarchicus Giesbrecht, 1892, pp. 89, 218, pl. 6, fig. 19; pl. 7, figs. 32, 33; pl. 8, figs. 3, 15, 21, 31, 33; 1898, p. 14.
Calanus finmarchicus Wheeler, 1899, p. 164, fig. 1.

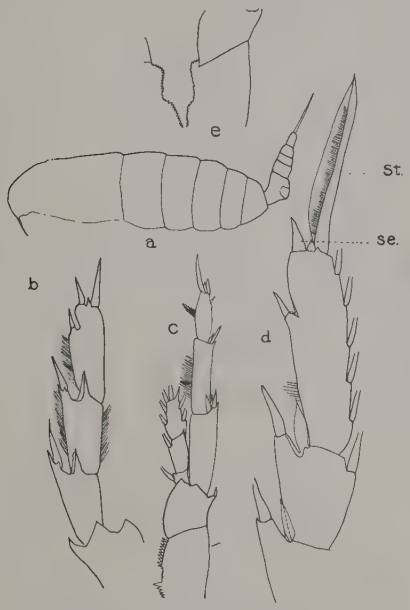

Fig. 1.—*Calanus finmarchicus.* (*a*) Female, lateral, ×18. (*b*) Outer ramus of right fifth foot of male ×195. (c) Left fifth foot of male ×140. (*d*) Outer ramus of third foot of male ×140. *St.*, terminal bristle. *Se.*, outer marginal bristle. (*e*) Basals of fifth foot of female ×195.

♀ Head not fused with thorax, front and lateral portions of fifth thoracic segment rounded, furcal bristles symmetrical. Anterior antennae extending about to end of abdomen, aesthetasks not doubled on any joint. Distal margin of second basal of second to fourth feet with a tooth; the proximal spine of the outer margin of terminal joint of outer ramus divides the margin in these pairs (respectively) into portions as 2:1, 2:1, 3:1.

First basal of fifth pair with concave dentate inner border (fig. 1*e*).

♂ Head not fused with thorax, anterior antennae straight; outer ramus of right fifth foot without bristles on inner margin (fig. 1*b*), terminal bristles sometimes dentate, thorn-like. Basals and proximal joint of outer ramus of left foot (fig. 1*c*) elongate, terminal joint of outer ramus shortened. Outer ramus of right foot (excluding terminal bristle) reaches at most to the distal end of the second joint of the outer ramus of the left foot. Inner rami of both feet similar in structure.

Coloration: Rather transparent, with variably distributed red pigment. In some cases this is found only in one of the anterior antennae, in others in the thorax and appendages, while the entire body of some animals is brightly colored.

Length: Both sexes, 2.6-3.1 mm.

Occurrence: Probably the commonest species in the San Diego region, occurring abundantly in nearly all collections with the larger nets; in some cases *C. finmarchicus* is almost the only species, and is very often predominant.

2. **Calanus minor** Claus.

Cetochilus minor Claus, 1863, p. 172, pl. 26, figs. 1-8.
Calanus valgus Brady, 1883, p. 33, pl. 3, figs. 1-7.
Calanus minor Giesbrecht, 1892, p. 90, pl. 6, figs. 3, 16, 22; pl. 7, figs. 6-22; pl. 8, figs. 1, 9, 19, 30; 1898, p. 15.
Calanus minor Wheeler, 1899, p. 165, fig. 2.

Fig. 2.—*Calanus minor.* Female, lateral, ×31.

♀ Head fused with thorax, forehead and lateral edges of last thoracic segment rounded. Anterior antennae not as long as the body. Distal margin of second basal in second to fourth pairs of feet with a tooth; the proximal outer marginal spine of the terminal joint of the outer ramus, in the second to fourth pairs, respectively, divides the margin into portions as 5 : 4, 10 : 7, 2 : 1. Inner margin of first basal of fifth feet straight, more coarsely dentate than in *C. finmarchicus.*

♂ Anterior antennae bent into S-shape; joints 3, 4 and 5, and 24 and 25 fused. Right fifth foot with 2 bristles on inner margin of third joint of outer ramus, terminal bristle short; terminal joint of left foot with three small bristles.

Coloration: About as in *C. finmarchicus.*

Length: Female, 1.8-2 mm.; male slightly smaller.

Occurrence: Not at all abundant, but coming in most catches with *C. finmarchicus.*

3. **Calanus tenuicornis** Dana.

Calanus tenuicornis Dana, 1849, p. 278; 1852, p. 1069; 1855, pl. 73, figs. 10*a*, 10*b*.

Calanus tenuicornis Giesbrecht, 1892, pp. 90, 129, pl. 6, figs. 12, 13; pl. 7, figs. 5, 16, 23; pl. 8, figs. 18, 27; 1898, p. 18.

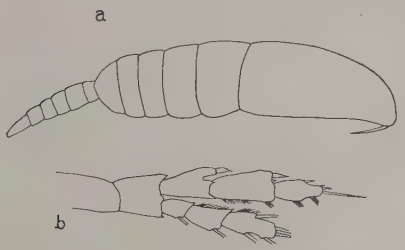

Fig. 3.—*Calanus tenuicornis.* (*a*) Male, lateral, ×31. (*b*) Left fifth foot of male ×83.

♀ Head not fused with thorax; forehead and angles of last thoracic segment rounded; bristle of furca asymmetrical, outer marginal minute. Anterior antennae at least 1½ times as long as the body. Proximal outer marginal spine of terminal joint of outer ramus in second to fourth feet, respectively, divides the margin into portions as 5:4, 10:7, 7:4.

♂ Anterior antennae as in ♀, except for fusion of joints 1 and 2, 3 to 5, 7 and 8, 9 and 10, 24 and 25. Mouth parts reduced; no bristle on inner margin of outer ramus of either of the fifth feet; terminal bristle of right thorn-shaped, that of the left slender; inner rami of both feet similar. Basal portion and two proximal joints of outer ramus of right elongate, terminal joint shortened.

Coloration: A variable amount of red or orange in antennae and mouth parts and oil drops of the same color in body.

Length: Female, 1.8-2 mm.; male, 1.5-1.8 mm.

Occurrence: Fairly abundant, both in summer and winter collections.

4. **Calanus gracilis** Dana.

Calanus gracilis Dana, 1849, p. 278; 1852, p. 1078; 1855, pl. 74, fig. 10.
Cetochilus longiremis Claus, 1863, p. 171, pl. 26, fig. 1.
Calanus gracilis Brady, 1883, p. 35, pl. 5, figs. 1-6; pl. 6, fig. 10.
Calanus gracilis Giesbrecht, 1892, pp. 90, 128; pl. 6, fig. 1; pl. 7, fig. 26; pl. 8, figs. 2, 4, 6-8, 12, 16, 26; 1898, p. 17.

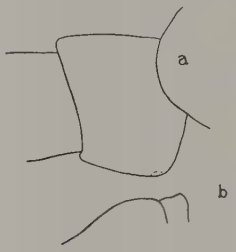

Fig. 4.—*Calanus gracilis.* (*a*) Genital segment of female, lateral, ×83. (*b*) Outer margin of first basal of anterior maxilliped of female ×140.

♀ Head fused with thorax; forehead and sides of last thoracic segment rounded. Left side of furca with one elongated bristle. Anterior antennae at least 1½ times as long as the body. There is a process at the base of the inner marginal bristle of the second basal of the second foot (cf. fig. 5*d*). The proximal outer marginal spine of terminal joint of outer ramus in second to fourth feet, respectively, divides the margin into portions as 1:1, 4:3, 4:3 in length. First basal of fifth pair with feathered inner margin.

♂ Head separate from thorax, anterior antennae straight, joints 1 and 2, 24 and 25 fused. Mouth parts greatly reduced. Outer border of third joint of outer ramus denticulate in second to fourth feet. Right foot of fifth pair and inner ramus of the left as in the preceding pairs; basals and first two joints of left foot elongate, third joint shortened, no bristle on inner border of outer ramus.

Coloration: Transparent, with little or no pigment in body.

Length: Female, 2.4 mm.

Occurrence: San Diego, July 14, 1903, one female; December 23, 1903, 14 females.

5. **Calanus robustior** Giesbrecht.

Calanus robustior Giesbrecht, 1888, p. 332; 1892, pp. 91, 129; pl. 7, figs. 15, 19, 25, 30; pl. 8, fig. 34; 1898, p. 18.

Calanus comptus Scott, T., 1893, p. 26, pl. 5, figs. 46-50; pl. 6, figs. 1-5.

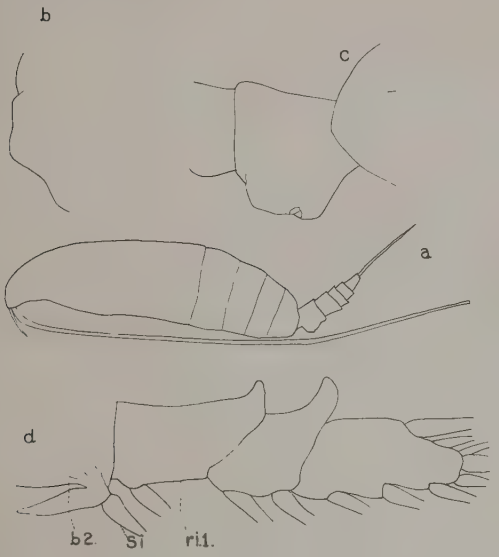

Fig. 5.—*Calanus robustior.* (*a*) Female, lateral, ×36. (*b*) Outer margin of first basal of anterior maxilliped of female ×140. (*c*) Genital segment of female, lateral, ×83. (*d*) Inner ramus of second foot of female ×185. *B.*2, second basal of foot. *Ri.*1, first joint of inner ramus. *Si.*, inner marginal bristle.

Allied to *C. gracilis,* but in the female the ventral surface of the genital segment is much more convex (cf. figs. 4*a* and 5*c*), and the first basal of the anterior maxilliped has a bulging protrusion on the outer border (cf. figs. 4*b* and 5*b*).

♂ Bristles on anterior maxilliped longer than in *C. gracilis,* inner ramus of left fifth foot stylet-like, jointed and without bristles, outer ramus much elongated.

Coloration: As in *C. gracilis.*

Length: Female, 3.17 mm.

Occurrence: San Diego, July 14, 1903, one female; December 21, 1904, December 29, 1904, one female each day.

Sub-fam. Eucalaninae.

Eucalanina Giesbrecht, 1892, p. 45.

♀ Body elongate, head for the most part much lengthened (figs. 6*a*, *b*) and seldom distinct from the first thoracic segment. Rostral filaments slender, abdomen usually with three segments, seldom with four; furca often fused with the anal segment. First and second and eighth and ninth joints of anterior antennae fused. The swimming feet, and especially the rami, are short in comparison with the length of the body; inner ramus of first pair 1- or 2- jointed, 3-jointed in the following pairs. Terminal bristle of outer rami with smooth edge, that of the first pair as in the succeeding three pairs; fifth pair absent or uniramous; if present, with from three to five joints.

♂ Body, especially the head, shortened (fig. 6*c*); anterior antennae without reduction in number of joints; furca as in the female. The mouth parts may be stunted. Fifth pair of feet not well developed, left foot uni- or biramous, right uniramous or lacking.

1. Genus **Eucalanus** Dana.

Calanus Dana, 1848, p. 11; 1849, p. 278.
Eucalanus Dana, 1852, p. 1047.
Eucalanus (in part) Lubbock, 1856, p. 13; 1860, p. 160.
Calanella Claus, 1863, p. 174; *not Eucalanus* Claus, 1881, p. 325.
Eucalanus Brady, 1883, p. 37.
Eucalanus Giesbrecht, 1888, p. 333; 1892, pp. 46, 131, 739; 1895, p. 246; 1898, p. 19.
Eucalanus Wheeler, 1899, p. 166.

Anal segment and furca fused, latter asymmetrical; head triangular, often elongate, fused with thorax; abdomen short, that of female with three or four segments, of the male with 5. Anterior antennae longer than body, 23-jointed in female, terminal bristles plumose and colored. Outer ramus of mandible 7- or 8- jointed and shorter than inner. Mandible of female longer than maxilla; second basal of mandible makes with the outer ramus a cylindrical body on which the inner ramus articulates proximally to the outer ramus (fig. 7*c*). Inner ramus of posterior maxilliped with long bristles. Swimming feet short; outer rami 3-jointed, inner ramus of first pair 2-jointed, of second to fourth pairs 3-jointed. Fifth pair absent in female; in male (fig. 6*d*)

both are uniramous. The left 4-jointed, the right 1- to 4- jointed or lacking. Head appendages of male retrograded and modified, body shortened.

KEY TO SPECIES.

Abdomen with 3 or 4 segments..... ♀
Abdomen with 5 segments..... ♂

♀1. Two segments between anal and genital segments (fig. 6a)..... **E. elongatus**
1. One segment between genital and anal segments (fig. 7*b*)..... 2
2. Inner border of second basal of mandible divided into two approximately equal portions by the insertion of the inner ramus (fig. 7*c*)..... **E. attenuatus**
2. Proximal portion much longer than distal..... 3
3. Two terminal bristles of left side of furca longer but hardly thicker than on the right side; genital segment (fig. 8*d*) much broader than long, onion-shaped..... **E. crassus**
3. Two terminal bristles of left side of furca longer and much thicker than on the right side. Second basal of maxilla with four inner marginal bristles; forehead (fig. 9*a*) triangular, rounded in front..... **E. subtenuis**

♂1. Both feet of fifth pair present..... 2
1. Right foot of fifth pair absent..... 3
2. Outer ramus of posterior antenna does not extend by far to the distal border of the first joint of the outer ramus..... **E. elongatus**
2. Outer ramus reaches almost to the distal border of first joint of inner..... **E. attenuatus**
3. Terminal joint of fifth foot at least as long as the apical bristle; outer border of second joint of inner ramus of second to fourth (as in fig. 8*a*) feet without tooth..... **E. crassus**
3. Terminal joint of fifth foot shorter than apical bristle... **E. subtenuis**

1. **Eucalanus elongatus** Dana.

Calanus elongatus Dana, 1848, p. 18; 1849, p. 278; 1852, p. 1079; 1855, pl. 75, figs. 1*a*, *b*.

Eucalanus elongatus Giesbrecht, 1892, pp. 131, 149, pl. 11, figs. 2, 7, 12, 20, 25, 32, 36; 1895, p. 246; 1898, p. 20.

♀ Two free segments between genital and anal, former longer than broad (fig. 6*a*, *b*). Forehead of regular triangular shape. First and second joints of outer ramus of posterior antennae not fused, first joint of inner ramus little longer than the second and over three times as long as broad. Inner margin of second basal of mandible with three bristles. End of inner ramus does not reach distal end of second basal by about the length of the ramus; its first joint with 2, the second with 5 bristles. Sec-

ond lobe of inner margin of maxilla present, third lobe with four, second basal with 5 bristles. First joint of inner ramus of posterior maxilliped with 3 bristles, second with 4.

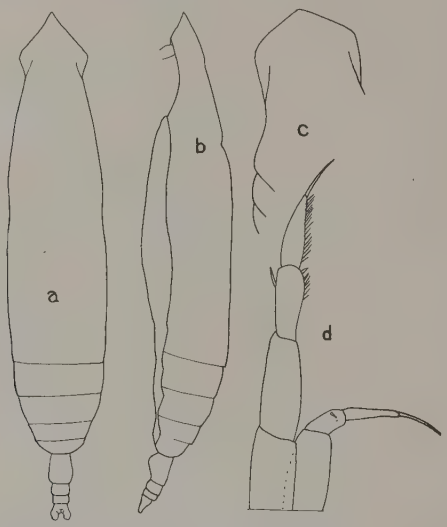

Fig. 6.—*Eucalanus elongatus.* (*a*) Female, dorsal, ×15. (*b*) Female, lateral, ×15. (*c*) Head of male, dorsal, ×37. (*d*) Fifth foot of male, ×40; left foot at left of figure.

♂ Pronounced secondary sexual characters; right fifth foot present, left as long as the fourth foot exclusive of terminal bristle.

Coloration: Very transparent, with a small though varying amount of red in the body, usually limited to a single oil-drop near the posterior end of the thorax. (See note also.)

Length: Female, 4.4-7.5 mm.; male, 4 mm.

Occurrence: A very common species, present in practically all hauls with the 000 net, both in winter and summer.

The most numerous specimens belong to a variety of *E. elongatus* as in Giesbrecht's monograph (1892), in which the last thoracic segment is rounded instead of pointed. But Giesbrecht, 1895, p. 246, calls attention to this difference. The typical form with pointed thoracic segment occurs in the San Diego region, and so far one specimen has been taken, a female, length 7½ mm. The bristles on the posterior maxillipeds and the maxilla are faintly orange, those on the feet a rich orange, as far as seen, the feet being badly broken.

2. **Eucalanus attenuatus** Dana.

Eucalanus attenuatus Dana, 1848, p. 18; 1849, p. 278; 1852, p. 1080; 1855, pl. 75, figs. 2*a-e*.
Calanus mirabilis Lubbock, 1856, p. 16, pl. 5, figs. 1-6.
Calanella mediterranea Claus, 1863, p. 176, pl. 28, figs. 6-11.
Eucalanus attenuatus Giesbrecht, 1892, pp. 131, 150, pl. 3, fig. 1; pl. 11, figs. 1, 11, 13, 16, 18, 24, 40; pl. 35, figs. 3, 6, 17, 25, 34, 37; 1898, p. 20.

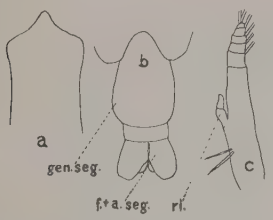

Fig. 7.—*Eucalanus attenuatus.* (*a*) Head of female, dorsal, ×20. (*b*) Abdomen of female, ×31. *Gen. seg.*, genital segment. *F.+a. seg.*, furca and anal segment. (*c*) Mandibular rami, female, ×31. *Ri.*, inner ramus.

♀ Forehead (fig. 7*a*) triangular, indented on each side, much tapering. Genital segment longer than broad, between it and anal segment but one free segment (fig. 7*b*). First joint of inner ramus of posterior antenna 4 times as long as broad and 1⅓ times as long as the second; two inner marginal bristles on second basal of mandible (fig. 7*c*), end of inner ramus distant from distal end of second basal more than the length of the ramus. Maxilla as in *E. elongatus;* first joint of inner ramus of posterior maxilliped with 3 bristles, second with four.

♂ Pronounced secondary sexual characters; right fifth foot present, left considerably shorter than the fourth foot.

Coloration: Similar to that of *E. elongatus;* I have never seen animals with the plumes at the ends of the antennae entire; in Wheeler's specimens they were colorless; in Giesbrecht's at times orange and iridescent.

Length: Female, from 4 to less than 5 mm.; male, under 3.5 mm.

Occurrence: A few come in the hauls with *elongatus,* but are not nearly so common. They were especially abundant in June and July, 1903.

3. **Eucalanus crassus** Giesbrecht.

Eucalanus crassus Giesbrecht, 1888, p. 333; 1892, pp. 132, 151; pl. 11, figs. 8, 10, 17, 21, 22, 38; pl. 35, figs. 4, 20, 26-28; 1898, p. 22.

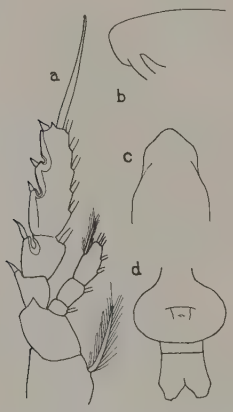

Fig. 8.—*Eucalanus crassus.* (*a*) Fourth foot of female ×83. (*b*) Head of female, lateral, ×18. (*c*) Head of female, dorsal, ×18. (*d*) Abdomen of female, ventral, ×83.

♀ Genital segment (fig. 8*d*) much broader than long, onion-shaped; between it and anal segment but one free segment. Forehead (fig. 8*c*) flatly rounded, furca and second terminal bristle slightly asymmetrical. First two joints of outer ramus of posterior antennae fused, first joint of inner ramus shorter than second and about twice as long as broad. Inner ramus of mandible reaches the distal margin of second basal; first joint of inner ramus with two bristles, second joint with four. Second lobe on inner margin of maxilla absent, third lobe with three, second basal with 4 bristles; first and second joints of inner ramus of posterior maxilliped with 3 bristles.

♂ Secondary sexual characters not pronounced; right foot of fifth pair absent.

Coloration: Transparent; there was no pigment in my specimen.

Length: Female, 3 mm.

Occurrence: San Diego, June 16, 1904, one female.

4. **Eucalanus subtenuis** Giesbrecht.

Eucalanus subtenuis Giesbrecht, 1888, p. 333; 1892, pp. 132, 150. pl. 11, figs. 4, 23, 42; pl. 35, figs. 9-11, 18, 29, 30; 1898, p. 21.

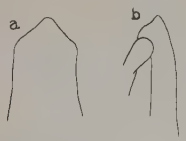

Fig. 9.—*Eucalanus subtenuis.* (*a*) Head of female, dorsal, ×20. (*b*) Head of female, lateral, ×20.

♀ Genital segment somewhat longer than broad, between it and anal segment one free segment; forehead (fig. 9*a*) as in *E. attenuatus,* but less prolonged and not indented on sides. First joint of outer ramus of posterior antennae fused with second, first joint of inner ramus 3 times as long as broad, and as long as second joint; second basal of mandible with 2 bristles on inner border, first joint of inner ramus with 2 bristles, second with 4; second inner lobe of maxilla absent, third with 4 bristles, second basal with 4; same number on first joint of inner ramus of posterior maxilliped.

♂ Secondary sexual characters not pronounced; right fifth foot absent.

Coloration: Transparent, without pigment.

Length: Female, 2.7 mm.

Occurrence: San Diego, June 16, 1904, one female.

2. Genus **Rhincalanus** Dana.

Calanus Dana, 1848, p. 11; 1849, p. 278.
Rhincalanus Dana, 1852, p. 1082; 1855, pl. 76, figs. 2*a-d.*
Rhincalanus Brady, 1883, p. 40.
Rhincalanus Giesbrecht, 1888, p. 334; 1892, pp. 47, 152, 761; 1898, p. 22.
Rhincalanus Scott, T., 1893, p. 30.

♀ Five segments in cepalothorax (head and thorax fused), fourth and fifth thoracic segments distinct. Head similar to *Eucalanus attenuatus,* but produced into a snout-like process (fig. 10*a*). Abdominal and thoracic segments with spines; abdomen with 3 segments, furca fused with last segment, and asym-

metrical. Anterior antennae much longer than body, 23-jointed (joints 1 and 2, 8 and 9 fused); rami of posterior antennae equal in length; mandible not longer than the maxilla. Swimming feet short, rami of first pair 2-jointed, of second to fourth pairs 3-jointed. Fifth foot (fig. 10*b*) uniramous, present on both sides, each 3-jointed; second joint with one plumose bristle, third with two; a thicker bristle at end of third joint, plumose on inner border.

♂ Anterior antennae shortened; fifth foot on the left side 2-jointed.

Left fifth foot biramous..... ♂
Both feet of fifth pair uniramous..... ♀

1. **Rhincalanus nasutus** Giesbrecht.

Rhincalanus nasutus Giesbrecht, 1888, p. 334; 1892, pp. 152, 160; pl. 3, fig. 6; pl. 9, figs. 6, 14; pl. 12, figs. 9-12, 14, 16, 17; pl. 35, figs. 46, 47, 49; 1898, p. 22.

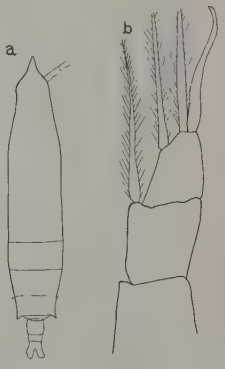

Fig. 10.—*Rhincalanus nasutus.* (*a*) Female, dorsal, ×18. (*b*) Fifth foot of female ×260.

♀ Front of head elongated; indented on the sides (fig. 10*a*); rostral filaments ventral, not visible from above. Fifth foot with one bristle on second joint, three on third (fig. 10*b*.)

♂ Right fifth foot with strongly curved bristle at end; left with long outer ramus reaching almost to end of inner ramus.

Coloration: Transparent; small amount of red on sides of body and faint yellowish tinge to whole, distinct from the glass-like clearness of *Eucalanus*.

Length: Female, 3 mm.; male, 2.7 mm.

Occurrence: A female was first seen, San Diego, June 10, 1904, but two or three occur in most catches when *Eucalanus* is abundant.

3. Genus **Mecynocera** I. C. Thompson.

Leptocalanus Giesbrecht, 1888, p. 334.
Mecynocera Thompson, I. C., 1888*a*, p. 150.
Mecynocera, Giesbrecht, 1892, p. 160; 1898, p. 23.
Mecynocera Wheeler, 1899, p. 167.

Furca symmetrical, articulating with anal segment; mandible shorter than maxilla and less than half as long as the fourth pair of feet, similar in structure to that of *Calanus*, but inner ramus is nearly as long as second basal and twice as long as outer ramus; inner ramus of posterior maxillipeds at least as long as first or second basal. First pair of feet with outer ramus of three joints, inner of one joint; fifth pair present, with five joints on either side. ♂ Unknown.

♀ Head distinct from thorax; rostral threads delicate; abdomen short, with three segments; genital segment and furca symmetrical. Anterior antennae of unequal length, more than twice as long as the body, with 23 joints, bristles few and very long. Inner ramus of posterior antennae nearly twice as long as outer ramus. The succeeding appendages, similar to those of *Calanus:* feet short, outer rami with three joints, inner ramus of first pair with one joint, of second to fourth with three; fifth pair with basals, outer ramus with three joints, inner ramus lacking.

1. **Mecynocera clausi** I. C. Thompson.

Mecynocera clausii Thompson, I. C., 1888*a*, p. 150, pl. 11, figs. 1-4.
Leptocalanus filiformis Giesbrecht, 1888, p. 334.
Mecynocera clausii Giesbrecht, 1892, p. 160, pl. 5, fig. 1; pl. 11, figs. 43, 45; pl. 35, figs. 21, 22; *M. clausi*, 1898, p. 23.
Mecynocera clausii Wheeler, 1899, p. 167, fig. 5.

The only species of the genus.

Coloration: Exceedingly transparent, without pigment in my specimens.

Length: Female, 0.9-1 mm.

Occurrence: The only specimens I have were collected December 30, 1903, on the "Banks" off Point Loma.

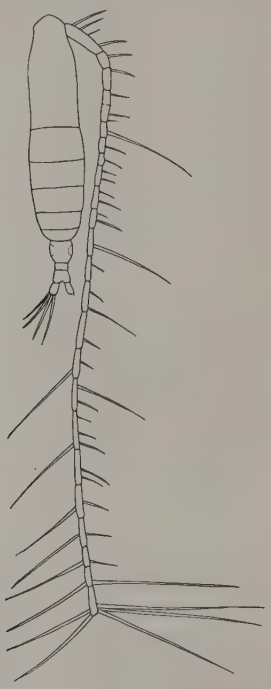

Fig. 11.—*Mecynocera clausi.* Female, dorsal, ×45.

Sub-fam. Paracalaninae.

Paracalanina Giesbrecht, 1892, p. 48.

♀ Cephalothorax with four segments, abdomen with from two to four; rostrum ends in two soft filaments. Anterior antennae 25-jointed, with long terminal joints, but the division between the first and second and eighth and ninth joints may not be clear. Outer ramus of posterior antennae at most as long as the inner ramus; the mouth parts like those of *Calanus.* Terminal bristle of outer rami of feet with smooth border; basals and rami set with spines; fifth foot rudimentary (2- 4- jointed) or lacking.

♂ Characters as in the male of *Calanus;* the number of joints in the anterior antennae more reduced, the end-joint always shortened, and sometimes fused with the preceding one; fifth pair of feet weakly developed, the left 5-jointed, the right 4- or 2-jointed, or lacking.

1. Genus **Paracalanus** Boeck.

Calanus Claus, 1863, p. 172.
Paracalanus Boeck, 1864, p. 8.
Paracalanus Claus, 1881, p. 326.
Paracalanus Bourne, 1889, p. 145.
Paracalanus Giesbrecht, 1892, pp. 48, 164, 757; 1898, p. 23.
Paracalanus Dahl, 1893, p. 21.
Paracalanus Wheeler, 1899, p. 168.

Second basal of first pair of feet with an inner marginal bristle; proximal division of outer border of third joint of outer ramus of fourth pair (fig. 12*a*) over twice as long as the distal; outer border of the second joint not dentate; proximal division of the outer border of third joint of outer ramus in the third and fourth feet dentate; scalpelliform terminal bristle of the outer ramus in the third pair longer than the end joint; second joint of inner ramus of first pair with 5, third of same in second pair with 7 bristles. The abdomen of the female (fig. 12*b*) with 4 segments; the last joint of anterior antennae less than 1½ times as long as the next to the last. Fifth foot of female short, 2-jointed (fig. 12*c*); right foot of male with 2 joints, left with 5 (fig. 12*c*).

♀ Head fused with first thoracic segment, and fourth thoracic segment with fifth. Rostrum produced into two thin filaments. Genital segment and furca symmetrical, latter without bristle on outer margin. Anterior antennae with 25 joints. Outer ramus of posterior antennae shorter than inner; mandible with broad blade, the sack-like appendage on the first joint of the inner ramus small. Maxilla with obscure segmentation of inner ramus, without bristle on the second lobe of outer border, and with but one on the first inner marginal lobe. Anterior maxilliped with outer marginal bristle. Inner ramus of the first swimming foot with 2 joints, of the second to fourth foot with 3 joints.

♂ Abdomen with 5 segments. Number of joints of anterior antennae reduced through fusion of joints 1 to 6 and 7 to 8, end joint shortened but free. Aesthetasks enlarged and numerous.

Mandibular blade, appendages on inner border of maxilla and anterior maxilliped stunted, those of posterior maxilliped less so, its outer marginal bristles long and richly plumose. The swimming feet show slight peculiarities.

1. **Paracalanus parvus** Claus.

Calanus parvus Claus, 1863, p. 173, pl. 26, figs. 10-14; pl. 27, figs. 1-4.
Paracalanus parvus Claus, 1881, p. 327, pl. 3, figs. 1-16.
Paracalanus parvus Bourne, 1889, p. 145, pl. 11, figs. 1-3.
Paracalanus parvus Giesbrecht, 1892, pp. 164, 170; pl. 1, fig. 5; pl. 6, figs. 28-30; pl. 9, figs. 5-11, 25, 27, 31, 32; 1898, p. 2a.

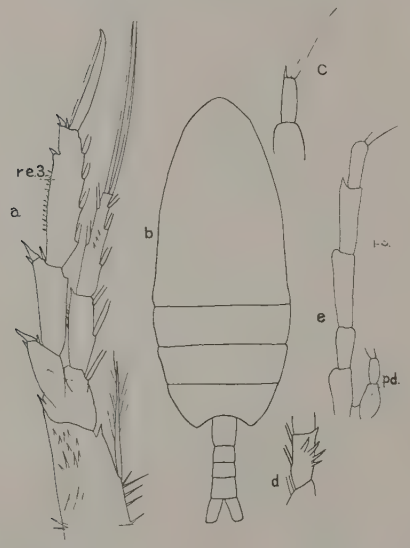

Fig. 12.—*Paracalanus parvus.* (*a*) Fourth foot of female ×195. *Re.*3, third joint of outer ramus. (*b*) Female, dorsal, ×83. (*c*) Fifth foot of female ×410. (*d*) Second joint of inner ramus of second foot of female ×195. (*e*) Fifth foot of male. *Ps.*, left foot. *Pd.*, right foot.

♀ Inner bristle of furca barely longer than the furca. Anterior antennae reach, when brought to the sides of the body, perhaps to the posterior border of the third abdominal segment.

First joint of inner ramus of maxilla with two bristles on anterior face. Third lobe of second basal of posterior maxilliped with two bristles. Inner margin of first basal of the fourth pair of feet ends in one or two points (fig. 12*a*); anterior and posterior faces of first basal of second to fourth pairs set with hairs and spines; surfaces of first and second joints of outer ramus of the third pair and of second joint of the fourth, naked. Fifth foot rudimentary, symmetrical.

♂ Fifth foot asymmetrical (fig. 12*e*); compare also generic description.

Coloration: Rather transparent, with red pigment in varying amounts and distribution, never very abundant.

Length: Both sexes within 0.8-1.2 mm.

Occurrence: Fairly common in hauls with smaller nets, both sexes being present summer and winter.

Sub-fam. Clausocalaninae.

Clausocalanina Giesbrecht, 1892, p. 49.

♀ Head usually fused with the first thoracic segment, fourth thoracic always fused with the fifth; rostrum ends in two short, soft filaments or is lacking; abdomen with four segments, furca symmetrical. Eighth and ninth joints of anterior antennae fused; terminal joint short, seldom fused with the preceding one. Outer ramus of posterior antennae 6-jointed and always longer than the inner ramus. The other appendages of the head for the most part as in *Calanus*. Inner ramus of the first pair of feet 1-jointed, of the second pair 2-jointed, of the third and fourth 3-jointed; terminal bristle of the outer rami with dentate border; third joint of outer ramus in second to fourth pairs with three bristles on outer border. Fifth pair rudimentary on each side, 3-jointed or lacking.

♂ Unknown in *Spinocalanus* and *Ctenocalanus*. Abdomen with shortened anal segment; anterior antennae and head appendages in some cases like those of the female, in others as in the *Paracalaninae*. Fifth pair of feet: the right, 1- to 5-, the left 5- jointed.

1. Genus **Clausocalanus** Giesbrecht.

Calanus Dana, 1849, p. 278; 1852, p. 1047.
Calanus Claus, 1863, p. 172.
Eucalanus Claus, 1881, p. 325.
Drepanopus (in part) Brady, 1883, p. 76.
Clausocalanus Giesbrecht, 1888, p. 334; 1892, pp. 50, 185, 733; 1898, p. 27.

Rostrum with two points; second basal of second and third swimming feet with toothed distal margin and broad outer ramus. Mouth parts and number of segments of anterior antennae reduced.

♀ Head fused with thorax and the fourth with the fifth thoracic segment. Abdomen with four segments, genital segment and furca symmetrical. Anterior antennae extend beyond the thorax, 23-jointed. Outer ramus of posterior antennae 1½ times as long as the inner, the former 6-jointed, with short bristles on the proximal joints. First joint of inner ramus of mandible with a very small, sack-like appendage. Maxilla and maxillipeds as in *Calanus,* outer marginal bristle lacking on anterior maxillipeds. Outer rami of swimming feet with 3 joints; inner ramus of first foot 1-jointed, of second 2-jointed, of third and fourth 3-jointed. End joint of outer ramus with finely dentate terminal bristle, and four bristles on inner border in second to fourth pairs; fifth pair uniramous, 3-jointed.

♂ Head fused with first thoracic segment, and elongated at expense of free thorax rings. Rostrum suppressed; abdomen with five segments, anal very short. Anterior antennae with joints 8-10, 13-16, 20-21, 24-25 fused. Outer ramus of posterior antennae twice as long as inner. Blade of mandible, appendage of inner border of maxilla, and anterior maxilliped suppressed; less so the posterior maxilliped, the outer marginal bristle of which is not enlarged. Swimming feet elongated. Left fifth foot (fig. 13*c*) long, uniramous and with 5 joints, right short, 1- to 3-jointed.

1. **Clausocalanus arcuicornis** Dana.

Calanus arcuicornis Dana, 1849, p. 278; 1852, p. 1056; 1855, pl. 72, fig. 9*a-b*.
Calanus mastigophorus Claus, 1863, p. 173, pl. 27, figs. 5-8.

Clausocalanus arcuicornis Giesbrecht, 1888, p. 334; 1892, pp. 186, 193; pl. 1, fig. 14; pl. 2, fig. 7; pl. 10, figs. 3-8, 14, 16, 17, 19; pl. 36, figs. 29-31, 34; 1898, p. 27.
Clausocalanus arcuicornis Wheeler, 1899, p. 171, fig. 9.

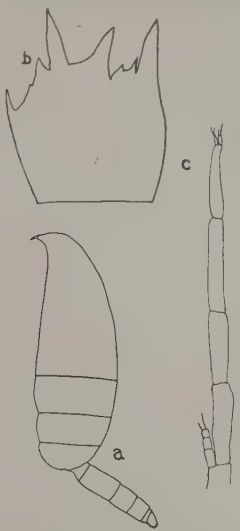

Fig. 13.—*Clausocalanus arcuicornis.* (*a*) Male, lateral, ×45. (*b*) Second basal of second foot to show toothed distal margin, ×410. (*c*) Fifth foot of male ×83.

♀ Genital segment longer than the two following. Furca about as long as broad. No aesthetask on fourth, sixth, eighth, eighteenth or twenty-second joints of the anterior antennae.

♂ Second segment of abdomen at least as long as the third and fourth together (fig. 13*a*); right foot of fifth pair with three joints (fig. 13*c*).

Coloration: Not very transparent, with red pigment in various places on the posterior part of the body and on genital segment.

Occurrence: San Diego, June 25, 1904, one male.

Sub-fam. AETIDIINAE.

Aetidiina Giesbrecht, 1892, p. 52.
Aetidiinae Wolfenden, 1903, p. 263.

♀ Head sometimes distinct from first thoracic segment; otherwise the cephalothorax always has four segments, as has the

abdomen invariably. Rostrum strongly chitinized, usually with one point, seldom with two or lacking. Genital segment and furca usually symmetrical. In the anterior antennae the eighth and ninth and twenty-fourth and twenty-fifth joints are fused. Outer ramus of posterior antennae at least fully as long as the inner, and usually longer; the second and third joints of the outer ramus are distinct. Mandible as in *Calanus,* with strong blade, and occasionally shortened inner ramus. Maxilla with well developed lobes on inner margin and usually with hooked bristles even on the second basal and the inner ramus; outer ramus relatively small. Bristles of anterior maxilliped short but strong, those of the inner ramus relatively slender and sparsely plumose; the articulation of the inner ramus is rather on the posterior surface of the second basal than at the end. Inner ramus of posterior maxillipeds at most ⅔ as long as the second basal. Inner ramus of first swimming feet always 1-jointed; that of the second almost always 1-jointed, while in the second and third the inner ramus is 3-jointed; the form of the swimming feet as in the Clausocalaninae; inner marginal bristle of first basal long and plumose.

♂ Known in *Aetideus, Euchirella* and *Undeuchaeta.* Characters like those of *Clausocalanus;* occasionally the twentieth and twenty-first joints of one of the anterior antennae are fused. Left foot of fifth pair 5-jointed (if the right is lacking, or stylet-like, in which case the right is claw-like).

1. Genus **Aetideus** Brady.

Aetidius Brady, 1883, p. 75.
Aetidius Thompson, 1888b, p. 142.
Aetidius Giesbrecht, 1892, pp. 53, 213.
Aetideus Wolfenden, 1903, p. 266; 1904, p. 116.
Aetideus Giesbrecht, 1898, p. 31.

♀ Cephalothorax and abdomen with four segments, symmetrical; rostrum large, prolonged into two thick chitinous prongs; last thoracic segment produced into a spine on each side. Anterior antennae 23-jointed, reaching about to the end of body. Rami of posterior antennae about equal in length, outer ramus 7-jointed. Outer rami of all swimming feet 3-jointed, inner ramus of first and second pairs 1-jointed, of third and fourth 3-jointed. Fifth pair of feet absent.

♂ Anal segment very short, abdomen with five segments. Anterior antennae 20-jointed, joints 8-10, 12 and 13, 20 and 21, 24 and 25 fused. Blade of mandible, appendages of inner border of maxilla and anterior maxilliped stunted. Left fifth foot uniramous, 5-jointed; right lacking; swimming feet as in female.

1. **Aetideus armatus** Brady.

Aetidius armatus Brady, 1883, p. 75, pl. 10, figs. 5-16.
Aetidius armatus Giesbrecht, 1892, p. 213, pl. 2, fig. 6; pl. 14, figs. 1-13; pl. 36, figs. 6-9.
Aetideus armatus Giesbrecht, 1898, p. 31.
Aetideus armatus Wolfenden, 1903, p. 266.

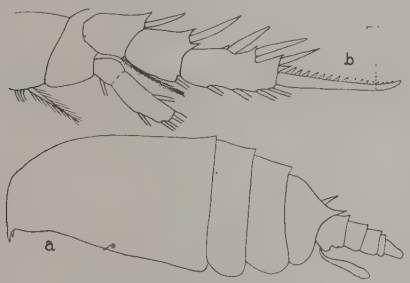

Fig. 14.—*Aetideus armatus.* Female. (*a*) Animal from side ×20. (*b*) Second foot ×83. *St.*, terminal bristle of outer ramus.

With the characters of the genus.

Coloration: Rather transparent; there was no pigment in my specimens, but Giesbrecht says that red may occur in the body.

Length: Female, 3 mm.

Occurrence: San Diego, June 9, 1904, one female; June 14, two females.

2. Genus **Gaidius** Giesbrecht.

Gaidius Giesbrecht, 1895, p. 249; 1898, p. 32.
Gaidius Wolfenden, 1902, p. 365; 1903, p. 266; 1904, p. 114, pl. 9, figs. 7, 8.

Rostrum short, one point (fig. 15*b*), sides of last thoracic segments produced into a sharp spine (fig. 15*a*). Inner ramus of posterior antennae three-fourths as long as outer. Outer ramus of first foot 2-jointed, of the second to fourth 3-jointed, inner ramus of first and second feet 1-jointed, of the third and fourth 3-jointed.

May be distinguished from *Aetideus* by the form of the rostrum, relatively shorter inner ramus of the posterior antennae, and by the fusion of the proximal joints of the outer ramus of the first foot (fig. 15*d*).

1. **Gaidius pungens** Giesbrecht.

Gaidius pungens Giesbrecht, 1895, p. 249, pl. 1, figs. 1-4; 1898, p. 32.
Gaidius pungens Wolfenden, 1903, p. 266.

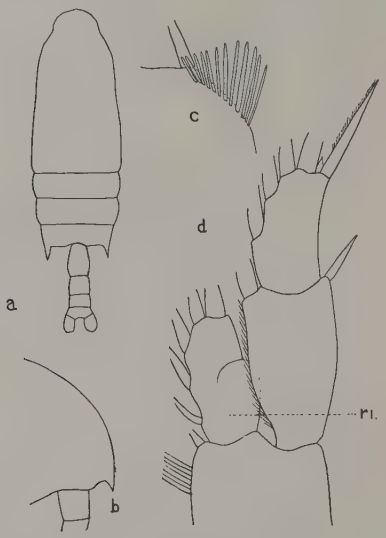

Fig. 15.—*Gaidius pungens.* Female. (*a*) Dorsal, ×18. (*b*) Head, lateral, ×45. (*c*) Tube-like processes on inner distal portion of second basal of fourth foot ×195. (*d*) First foot ×195. *Ri.*, inner ramus.

♀ Anterior antennae reaching at least to posterior border of thorax. The processes on the inner border of the first basals of the fourth feet are heavier and stiffer than in the preceding pairs, being almost tube-like (fig. 15*c*).

♂ Unknown.

Coloration: Transparent, with little or no pigment.

Length: Female, 3 to 3.5 mm.

Occurrence: San Diego, May 31, 1904, eight females; two males which seem to be of this species were taken also at this time, but they are distinctly immature.

3. Genus **Undeuchaeta** Giesbrecht.

Euchaeta (in part) Brady, 1883, p. 57.
Undeuchaeta Giesbrecht, 1888, p. 335; 1892, pp. 54, 227, 766; 1898, p. 33.
Undeuchaeta Sars, 1900, p. 58, pls. 15, 16.
Undeuchaeta Wolfenden, 1903, p. 267.

♀ Abdomen with four segments, the first with the genital opening on the convex ventral surface, at least as long as the second and longer than the last segment. Lateral angles of last thoracic segment rounded, or at least not produced into spines. Anterior antennae 23-jointed, outer ramus of first foot 2-jointed, inner ramus 1-jointed. Outer ramus of posterior antennae at least 1½ times as long as the inner; outer ramus of maxilla (fig. 16*e*) small, middle bristles shorter than the distal and proximal ones, outer marginal lobe with much elongated middle bristles.

♂ Anterior antennae 21-jointed, cephalo-thorax with four segments, abdomen with five, anal segment very short. Head with rather high crest (fig. 16*d*), last thoracic segment prolonged into angles, but not pointed. Inner ramus of posterior antennae ¾ as long as the outer. Mandible, maxilla and maxillipeds much reduced. Outer ramus of first foot indistinctly 3-jointed. Left foot of fifth pair uniramous (inner ramus reduced to a very small, rod-like projection), outer ramus (fig. 16*f*) ending in a short style (terminal joint of ramus). Right foot biramous. Terminal joint of outer ramus produced into a long stylet, inner ramus as in *Euchaeta* (cf. fig. 23*a*); outer ramus of each foot 3-jointed. The second joint of the outer ramus of the left foot (fig. 16*f*. *Re*. 2) bears a toothed process (fused with the joint) which flares distally; at the base of this and on the second joint is articulated a process, which together with the terminal joint of the ramus and the toothed process forms a forceps.

The abdominal segments are densely covered with fine spines or hairs, and the posterior margins of the segments are toothed.

In the structure of the fifth pair of feet these male animals very closely resemble the males of the genus *Euchaeta*, but seem

to be distinct from the latter in bearing an *articulating* process on the second joint of the outer ramus of the left foot. There is a muscle attached to the process which serves to move it.

The relative lengths of the rami of the posterior antennae distinguish the animals from *Euchirella,* as does the division (though indistinct) of the outer ramus of the first foot into three joints. In *Euchaeta,* the outer ramus of the first foot is distinctly 3-jointed in the male, and the rami of the posterior antennae are about equal in length. In several female specimens also the outer rami of the first feet are indistinctly divided into three joints, and the sexes correspond in this respect.

Sars (1900, p. 59-63) has described the male and female of *Undeuchaeta spectabilis.* So far as I know, his is the first record of the male of the genus. In his specimens the anterior antennae of the female are 24-jointed, while in Giesbrecht's the number of joints is 23. In his description of the male, Sars gives the number of joints of the anterior antennae as 22, but in his drawing (pl. 16, fig. 2) there are but 21. The fifth pair of feet in the male of *U. spectabilis* is very different from that in the San Diego specimens, a striking point being that both the right and left feet are biramous.

The description of the male of the genus given above is based upon the San Diego specimens.

1. **Undeuchaeta major** Giesbrecht.

Euchaeta australis Brady, 1883, p. 65, pl. 21, figs. 5-11.
Undeuchaeta major Giesbrecht, 1888, p. 336; 1892, pp. 227, 232, pl. 37, figs. 56, 57, 59; 1898, p. 34.

♀ Head with median crest, genital segment with protrusion on right side and a hooked pointed appendage at the right of the genital opening (fig. 16*a*).

♂ (new) Compare generic description.

Coloration: Female not especially transparent, with red pigment on basals of posterior maxillipeds, and in mouth region. Male: plumose bristles of furca steel-blue; those of posterior antennae and mandible red; on the feet the bristles are faintly red on the outer ends.

Length: Female, 4.5-5.5 mm.; male, 6-6.5 mm.

Occurrence: Four females were taken from May 18 to June 23, 1904; five on December 23, 1904, on the "Banks." One male was taken in July, 1904; another on November 1, 1904, off Point Loma.

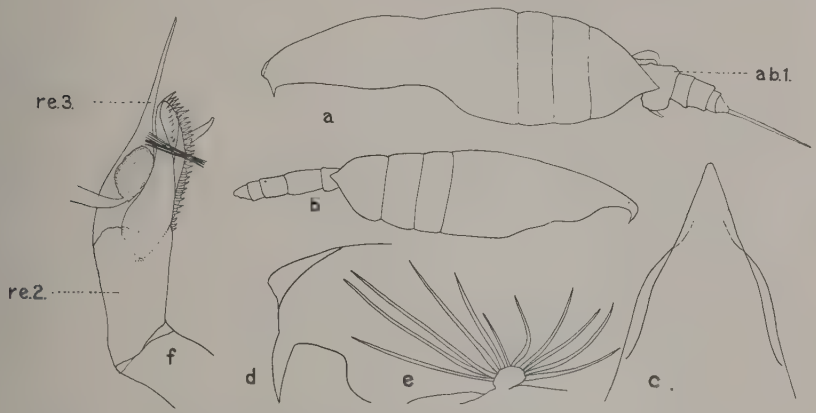

Fig. 16.—*Undeuchaeta major.* (*a*) Female, lateral, ×20. *Ab.*1, first abdominal segment. (*b*) Male, lateral, ×9. (*c*) Head of male, dorsal, ×83. (*d*) Head of male, lateral, ×83. (*e*) Outer ramus of maxilla of female ×195. (*f*) Distal portion of left fifth foot of male. *Re.*2, *Re.*3, respective joints of outer ramus.

2. **Undeuchaeta minor** Giesbrecht.

Undeuchaeta minor Giesbrecht, 1888, p. 335; 1892, pp. 228, 232, pl. 14, figs. 31-34; pl. 37, figs. 55, 58; 1898, p. 34.

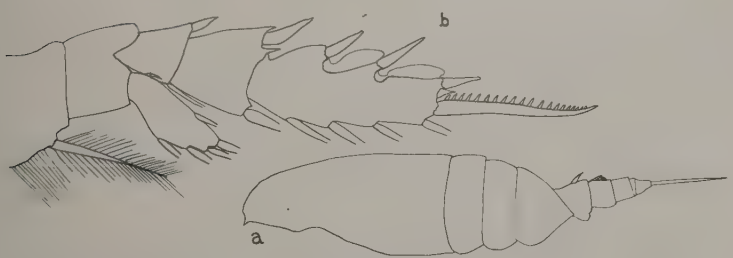

Fig. 17.—*Undeuchaeta minor.* Female. (*a*) Lateral, ×20. (*b*) Second foot ×83.

♀ Head without crest (fig. 17*a*), genital segment with a spine on the dorsal surface.

Coloration: Similar to that of *U. major*. The digestive tract of the single specimen was filled with orange red material.

Length: Female, 3.18 mm.

Occurrence: San Diego, June 14, 1904.

4. Genus **Euchirella** Giesbrecht.

Undina (in part) Lubbock, 1856, p. 21.
Calanus (in part) Lubbock, 1856, p. 15.
Undina Claus 1863, p. 186.
Euchaeta (in part) Brady, 1883, p. 59.
Euchirella Giesbrecht, 1888, p. 336; 1892, pp. 54, 233, 743; 1898, p. 34.
Euchirella Cleve, 1900, p. 4.
Euchirella Wolfenden, 1903, p. 267.

Rostrum present in most species, simple; lateral angles of last thoracic segment not pointed. Inner ramus of posterior antennae ½ to ¼ as long as the outer ramus, the two proximal joints of which are fused. Inner and outer rami of the maxilla short, the former provided with heavy hooked bristles. Outer ramus of the first pair of feet 2-jointed, that of the second to fourth pairs 3-jointed. Inner ramus of first and second pairs 1-jointed, of the third and fourth 3-jointed. Right foot of fifth pair of male with shear-like formation of distal portion, the left foot stylet-like (cf. figs. 18*d*, 19*b*).

♀ Head not always distinct from thorax, last two thoracic segments fused. Abdomen with four segments, genital segment and furcal bristles symmetrical or asymmetrical. Anterior antennae with 23 joints, reaching to the end of the thorax or somewhat beyond. Second basal of posterior maxillipeds twice as long as the 5-jointed inner ramus. Feathering on the inner margin of the proximal basal joint of the fourth pair of feet replaced by spines. Fifth pair of feet absent.

♂ Head occasionally with a median crest; abdomen with five segments, anal segment very short. Joints 20 and 21 of right anterior antennae fused, inner ramus of posterior antenna relatively longer than in the female. Blade of mandible, appendages on inner border of maxilla, and anterior maxillipeds reduced;

posterior maxilliped slender. Spines on second basal of fourth foot unusual. Right foot of fifth pair biramous, with forceps; left stylet-like, with rudimentary inner ramus.

KEY TO SPECIES.

Fifth foot absent ..... ♀
Fifth foot present ..... ♂
♀1. Head without crest, and rostrum one-pointed (fig. 19*a*) 2
1. Head with crest, rostrum present (fig. 20*a*) 4
2. Outer ramus of posterior antenna about twice as long as inner.. ..... **E. rostrata**
2. Outer ramus nearly four times as long as inner (fig. 20*c*) 3
3. Genital segment with long sac-like appendage on left side (fig. 18*b*) ..... **E. messinensis**
4. Head with low crest (fig. 20*a*) ..... **E. pulchra**
4. Head with high crest (fig. 22*a*) ..... **E. galeata**
♂ Head with low crest (fig. 18*c*) 2
Head without crest (fig. 21*a*) 3
2. Forceps-like terminal portion of right fifth foot longer than the basal portion (fig. 18*d*) ..... **E. messinensis**
2. Terminal portion (forceps) of right fifth foot shorter than the basal portion (fig. 20*b*) ..... **E. pulchra**
3. Fifth foot short, the right about four times as long as the second basal is broad (fig. 21*b*) ..... **E. amoena**
3. Right fifth foot six times as long as the second basal joint.. **E. rostrata**

1. **Euchirella messinensis** Claus.

Undina messinensis Claus, 1863, p. 187, pl. 31, figs. 8-18.
Euchirella messinensis Giesbrecht, 1892, pp. 232, 244; pl. 15, figs. 12, 16, 21, 24; pl. 36, figs. 14, 15, 18, 24, 25; 1898, p. 35.

♀ Forehead with rostrum, without crest (fig. 18*a*); genital segment asymmetrical, with sac-like appendage on left side of dorsal surface (fig. 18*b*); third terminal bristle on right side of furca elongated. Inner ramus of posterior antenna ¼ as long as outer, second joint of former with 5-4 bristles. First basal of fourth pair of feet with one or two spines on inner border, the longer of which reaches beyond the end of the joint.

♂ Forehead with a low and rather long crest (fig. 18*c*); fifth foot slender, the right foot (fig. 18*d*) over seven times as long as the second basal is broad, the forceps longer than the basals.

Coloration: Not very transparent; red pigment in body and on bristles of posterior antennae, and basals of swimming feet.

Length: Female, 4.5 mm.; male, 4 mm.

Occurrence: July 9, 1903, one male; July 22, 1903, one female.

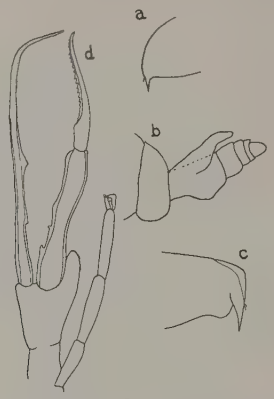

Fig. 18.—*Euchirella messinensis.* (*a*) Head of female, lateral, ×15. (*b*) Abdomen of female ×15. (*c*) Head of male ×30. (*d*) Fifth foot of male ×20.

2. **Euchirella rostrata** Claus.

Undina rostrata Claus, 1866, p. 11, pl. 1, fig. 2.
Euchaeta hessei Brady, 1883, p. 63, pl. 20, figs. 1-13; pl. 23, figs. 11-14.
Euchirella rostrata Giesbrecht, 1892, pp. 233, 245, pl. 15, figs. 3, 13, 25; pl. 36, figs. 19, 20; 1898, p. 36.
Euchirella rostrata Cleve, 1900, p. 4, pl. 2, figs. 1-12.

♀ Front without crest, with rostrum, abdomen symmetrical. Inner ramus of posterior antennae ½ as long as outer ramus; second joint of inner ramus with 8-6 bristles. First basal of fourth pair of feet (fig. 19*b*; B. 1) with 6 or 7 triangular lamellae on the inner border. Bristle on outer margin of second joint of outer ramus of the second pair reaches at least to the point of the first bristle on the outer border of the third joint of the ramus.

♂ Head without crest, with rostrum. Fifth foot six times as long as its second basal joint. Margin of second joint of outer ramus not denticulate, third joint smooth. Inner ramus of posterior antenna ½ as long as outer. First basal of fourth foot without triangular lamellae. (Cleve 1900).

The male was described by Cleve, 1900, and is identical with *Euchaeta hessei* Brady.

Coloration: Red pigment as in *E. messinensis,* but more abundant, especially on swimming feet.

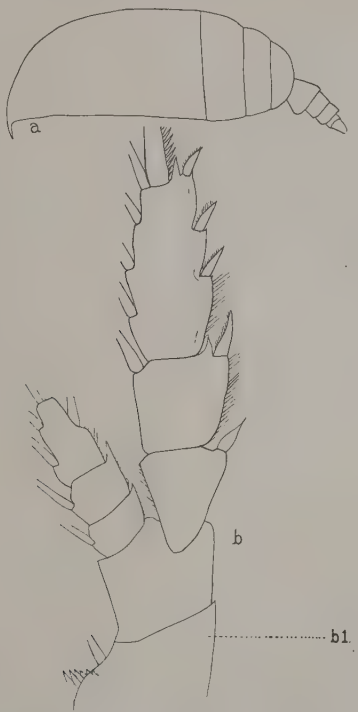

Fig. 19.—*Euchirella rostrata.* (*a*) Female, lateral, ×18. (*b*) Fourth foot, female, ×83. *B.*1, first basal, showing lamellar processes.

Length: Female, 2.97-3.1 mm.

Occurrence: San Diego, July 14, 16, 21, 1903, females; May 24, 1904, two females; June 2, 1904, one female.

3. **Euchirella pulchra** Lubbock.

Undina pulchra ♂ Lubbock, 1856, p. 26, pl. 4, figs. 5-8; pl. 7, fig. 6.
Calanus latus ♀ Lubbock, 1856, p. 15, pl. 2, fig. 12; pl. 11, figs. 8-11.

Euchaeta pulchra Brady, 1883, p. 63, pl. 14, fig. 7; pl. 20, figs. 15, 17, 19.

Euchirella pulchra Giesbrecht, 1892, pp. 233, 244, pl. 15, figs. 22, 23, pl. 36; figs. 13, 27; 1898, p. 36.

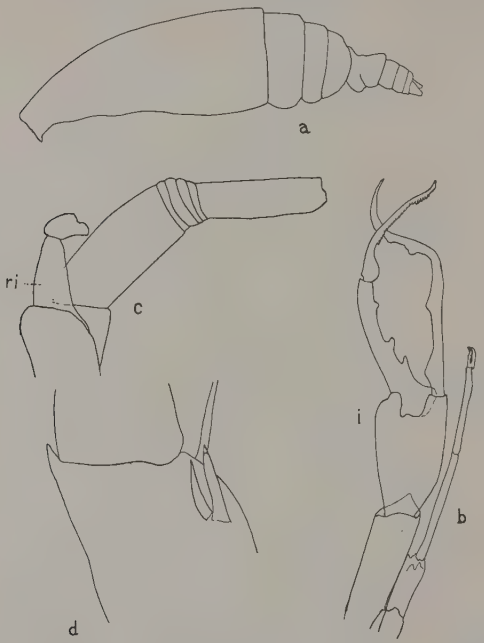

Fig. 20.—*Euchirella pulchra.* (*a*) Female, lateral, ×9. (*b*) Fifth foot of male ×45. (*c*) Rami of posterior antennae, to show relative lengths; bristles omitted, ×83. *Ri.*, inner ramus. (*d*) First basal of fourth foot of female ×140.

♀ Front with low crest (fig. 20*a*) and small rostrum. Genital segment asymmetrical; left side strongly convex in front of the middle of the segment, right side indented. Inner ramus of posterior antennae about ⅖ as long as outer ramus; second joint of inner ramus with 6-5 bristles. First basal of fourth pair of feet (fig. 20*d*) with one or two thorns about equal in length on the inner border, which do not reach the distal margin of the joint. Outer bristle of the second joint of the outer ramus of the second pair at most as long as the first outer bristle of the third joint.

♂ Considerably like *E. messinensis,* the chief difference being in the structure of the fifth pair of feet (fig. 20*b*). The claw of the right foot is shorter than the basal (in *messinensis* longer).

Coloration: About as in *E. messinensis.*

Length: Female, 3.4-4 mm.; male, 3.5 mm.

Occurrence: San Diego, May 31, 1904, two immature males, one female; June 23, 1904, one female adult; December 23, 1904, "Banks," eleven females, all adult; one male adult, December 30, 1904, on the "Banks."

4. **Euchirella amoena** Giesbrecht.

Euchirella amoena Giesbrecht, 1888, p. 336; 1892, pp. 233, 244; pl. 15, fig. 20; 1898, p. 36.

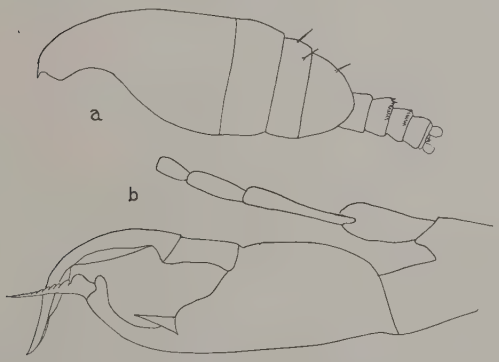

Fig. 21.—*Euchirella amoena.* Male. (*a*) Lateral ×20. (*b*) Fifth foot ×45.

♀ Unknown.

♂ Front without crest. Fifth pair of feet shortened, the right about four times as long as the second basal is broad.

Length: Male, 3.02 mm.

Occurrence: San Diego, May 28, 1904, one male.

5. **Euchirella galeata** Giesbrecht.

Euchirella galeata Giesbrecht, 1888, p. 336; 1892, p. 233, 244; pl. 15, fig. 18; pl. 36, figs. 22, 26; 1898, p. 36.

♀ Head with high crest, and rostrum; genital segment asymmetrical, strongly protruding on the posterior portion of the dorsal surface. Inner ramus of posterior antennae about ⅖ as

long as the outer; basals of fourth foot about as in *E. pulchra,* the spines not reaching to the distal border of the joint.

♂ Head as in the female.

Coloration: Opaque, without pigment.

Length: Female, 6.5 mm.

Occurrence: San Diego, November 18, 1904, one adult female, two immature males.

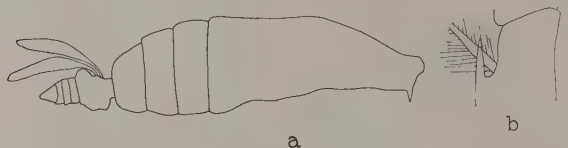

Fig. 22.—*Euchirella galeata.* Female. (*a*) Lateral ×9. (*b*) First basal of fourth foot ×83.

Sub-fam. Euchaetinae.

Euchaetina Giesbrecht, 1892, p. 55.

♀ Rostrum with one point; a pouch-like appendage in front of the upper labium. Inner marginal bristle of furca very long. Distal hooked bristles of anterior maxillipeds longer than the proximal. Outer ramus of first pair of feet 2-jointed, of the second to fourth 3-jointed; inner ramus of first and second pairs 1-jointed, of the third and fourth pairs 2-jointed.

♂ Abdomen as in the *Clausocalaninae.* Outer ramus of first pair of feet 3-jointed; fifth foot on each side with 2-jointed basal, and biramous; inner ramus of left stylet-like, of right truncate; left outer ramus 3-jointed, right 2-jointed.

1. Genus **Euchaeta** Philippi.

Euchaeta Philippi, 1843, p. 54, pl. 4, fig. 5.
Euchirus Dana, 1846, p. 183.
Euchaeta Dana, 1848, p. 20; 1849, p. 279; 1852, p. 1084.
Euchaeta Claus, 1863, p. 163.
Euchaeta Giesbrecht, 1892, pp. 55, 245, 740; 1895, p. 251; 1898, p. 37.

♀ Cephalothorax with five segments, the last two thoracic segments fused; abdomen with four segments, genital segment more or less asymmetrical. Anterior antennae of varying relative lengths, but of characteristic form, with 23 joints. Rami

of posterior antennae about equal in length, outer ramus with seven joints. Blade of mandible with few but strong teeth. Second basal joint of the posterior maxilliped at least three times as long as the inner ramus of five joints. Inner marginal bristle of first basal of the swimming feet long and richly plumose, terminal bristle of outer rami finely toothed; fifth pair absent.

♂ Head fused with thorax; abdomen with five segments, anal segment short; innermost bristle of furca shortened and bent at an angle. Blade of mandible, appendage of inner border of maxilla, and anterior maxilliped stunted; less obvious differences also in the posterior antennae and maxillipeds and swimming feet; outer ramus of first pair of feet 3-jointed. Feet of fifth pair long, strongly built, and of rather complicated structure (fig. 23*a*).

KEY TO SPECIES.

Fifth foot absent ..... ♀
Fifth foot present ..... ♂
♂1. Terminal joint at each foot of fifth pair, with long straight or slightly curved stylet; elevation for frontal organ not protruding ..... **E. acuta**
♀1. Hairs of frontal organ on a low elevation (fig. 25*b*) 2
1. Hairs of frontal organ on an elevation which extends toward the front (fig. 24*b*) 4
2. Genital segment with asymmetrical outgrowths (figs. 25*c*, *d*); no bristle in middle of outer border of first joint of outer ramus of the first foot; terminal bristles of furca about equal in length, the dorsal (inner) bristle much longer and thicker (fig. 25*g*) 3
3. Genital segment with a knob-like protuberance in front on the left side ..... **E. acuta**
3. Genital segment without such an outgrowth ..... **E. media**
4. Middle spine on outer border of terminal joint of second foot longer than the others, and the distal indentation in the border deeper (fig. 24*c*) 5
5. Anterior antennae longer than body ..... **E. spinosa**

1. **Euchaeta acuta** Giesbrecht.

Euchaeta acuta Giesbrecht, 1892, pp. 246, 262, pl. 16, figs. 6, 10, 14, 18, 21, 27, 39 ;pl. 37, figs. 47, 48, 52; 1898, p. 38.

♀ Elevation on front of head flat; genital segment asymmetrical, more strongly convex on the right side than on the left, and with more prominent process at the right of the opening; a knob-shaped outgrowth on anterior part on left side. Furca

with four terminal bristles nearly equal in length, inner bristle of furca much thicker than end bristles. Anterior antennae reach a little beyond the posterior end of the thorax.

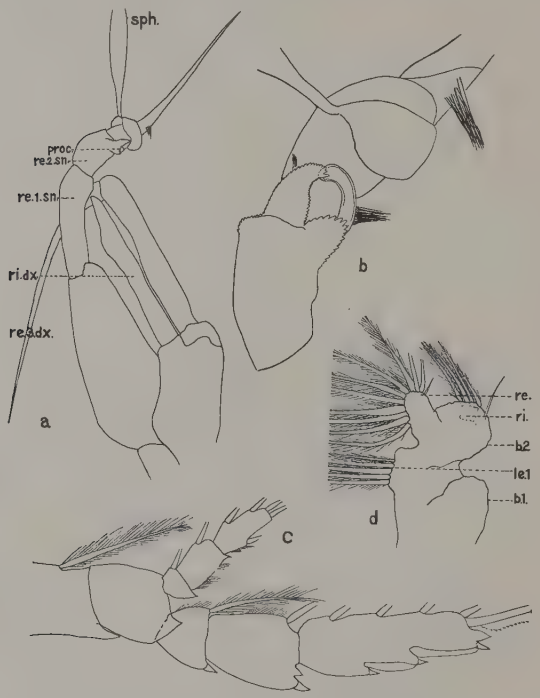

Fig. 23.—*Euchaeta acuta.* (*a*) Fifth foot of male ×37. *Ri. dx.*, inner ramus of right foot. *Re.* 3, *dx.*, third joint of outer ramus. *Re.* 1, 2, *sn.*, first and second joints of outer ramus of left foot. *Proc.*, process. *Sph.*, spermatophore. (*b*) Second and third joints of outer ramus of left fifth foot of male ×140. Parts as in *a*. (*c*) Second foot of male ×60. (*d*) Maxilla of male ×60. *B.*1, first basal. *B.*2, second basal. *Le.*1, first lobe of outer margin. *Ri.*, inner ramus. *Re.*, outer ramus.

First lobe of outer border of maxilla (*cf.* fig. 25*f*) with six bristles(one very small), second basal with three, fused second and third joints of inner ramus with four. Outer border of

first joint of outer ramus of first pair of feet concave; outer border of third joint of outer ramus of second pair and its outer bristles different than in the following pairs of feet; outer marginal bristle of second joint of outer ramus reaches almost to end of the first outer marginal bristle of the third joint. Third joint of outer ramus of left fifth foot of male (fig. 23*a*) with a stiletto-like process; second joint with a finely dentate, pyramidal and pointed process (*proc.*).

Coloration: Rather opaque, a fleck of red pigment in the mouth; most of the pigment is found on the back and sides of the cephalothorax, and on the posterior maxillipeds.

Length: Female, 4 mm.; male, 3.5-4 mm.

Occurrence: July 31, 1903, one male; June 23, 1904, one male and one female. A good many (12-15) males were taken at one time on December 23, 1903, on the "Banks."

2. **Euchaeta spinosa** Giesbrecht.

Euchaeta spinosa Giesbrecht, 1892, pp. 246, 263, pl. 16, figs. 12, 26, 34, 47; pl. 37, figs. 31, 34, 35, 50; 1898, p. 39.

♀ Elevation in front of head (fig. 24*a*) produced anteriorly; genital segment almost symmetrical, with large, flap-like projection at each side of the orifice (fig. 24*b*). Second terminal bristle of the furca longer than the other terminal bristles, dorsal bristle much thicker than the terminal ones. Anterior antennae reach beyond the end of the furca by more than the end joints. First outer marginal lobe of maxilla with eight bristles, second basal with three, fused second and third joints of inner ramus with four. Outer border of first joint of outer ramus of first foot concave; outer border of third joint of outer ramus of second pair and its outer bristles different than in the following pairs; outer marginal bristle of second joint reaches to the end of the first marginal bristle of the third joint (fig. 24*c*). Basals and rami of posterior pairs of feet covered in places with short spines (fig. 24*d*).

♂ Unknown.

Coloration: Red in cephalothorax, sometimes on furca. plumose bristles of maxillipeds same color. Eggs blue.

Length: Female, 6 mm. or over.

Occurrence: July 21, 1903, one female; May 26, 1904, one female; July 5, 1904, four females; May 28, 1904, two females, one with egg cases, one without.

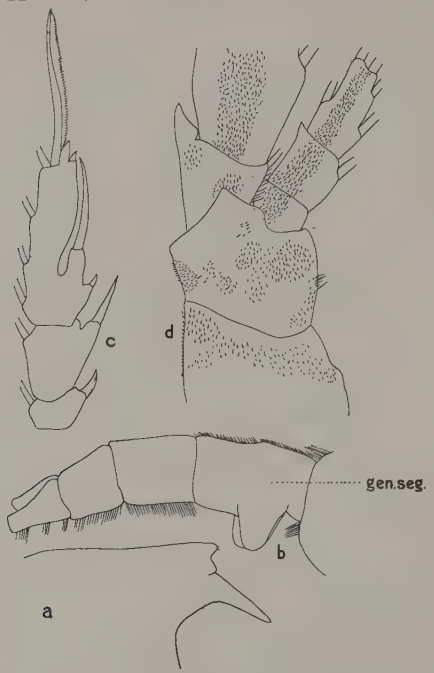

Fig. 24.—*Euchaeta spinosa.* Female. (*a*) Head, lateral, ×15. (*b*) Abdomen, lateral, ×48. *Gen. seg.*, genital segment. (*c*) Outer ramus of second foot ×45. (*d*) Basals, inner ramus, proximal joints of outer ramus of fourth foot ×45.

3. **Euchaeta media** Giesbrecht.

Euchaeta media Giesbrecht, 1888, p. 337; 1892, pp. 246, 263, pl. 16, figs. 13, 36; pl. 37, figs. 39, 40; 1898, p. 39.

♀ Elevation on front of head low (fig. 25*b*); genital segment asymmetrical with processes in the region of the orifice and a flap on the right side of the segment behind the orifice (figs. 25*c*, *d*); furca (fig. 25*g*) as in *E. acuta*. Anterior antennae extend a little beyond the posterior border of the genital segment.

First outer marginal lobe of the maxilla (fig. 25*f*) with eight bristles, second basal with three, fused second and third joints of the inner ramus with four. Outer border of first joint of outer ramus of first foot concave; outer border of third joint of second pair and its outer bristles different than in the following pair.

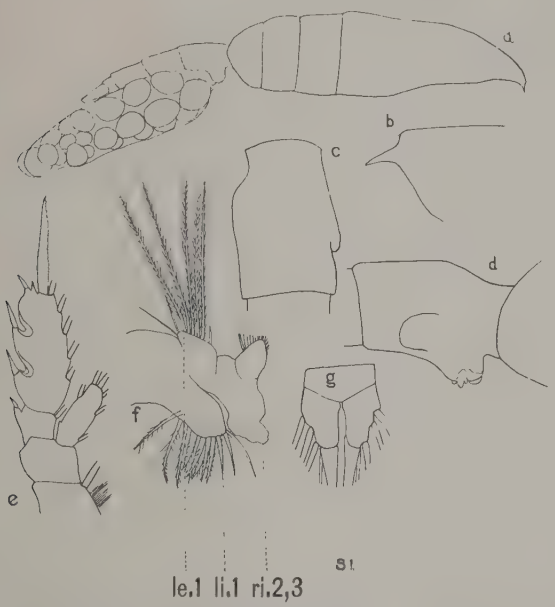

Fig. 25.—*Euchaeta media.* Female. (*a*) Lateral, ×18. (*b*) Head, lateral, ×83. (*c*) Genital segment, dorsal, ×45. (*d*) Genital segment, from right side ×45. (*e*) Second foot ×83. (*f*) Maxilla ×83. *Le.*1, first lobe of outer margin. *Li.*1, first lobe of inner margin. *Ri.*2, 3, fused second and third joints of inner ramus, bristles not shown. (*g*) Furca, dorsal, ×45. *Si.*, inner marginal bristle.

♂ Unknown.

Coloration: Rather transparent; there is no pigment in the preserved specimens I have seen.

Length: Females average about 3.3 mm.

Occurrence: Forty or fifty females, many with eggs, were taken December 23, 1903, on the "Banks" with males of *E.*

acuta. Three or four females were taken during June and July, 1904.

The specimens which I have placed in this species correspond to Giesbrecht's descriptions; but the females have hairs on the ventral sides of the abdominal segments, and Giesbrecht does not mention these nor figure them (1892, pl. 37, figs. 39, 40). The outer marginal lobe of the maxilla is always provided with eight bristles, but one of these is very inconspicuous and much shorter than the others. As these animals correspond very closely in other respects to Giesbrecht's specimens, especially in the form of the genital segment, I have thought best to include them under his species, even though there are slight differences.

Sub-fam. Scolecithricinae.

Scolecithricina Giesbrecht, 1892, p. 55.

♀ Head commonly fused with first, and fourth with fifth thoracic segment; rostrum with two usually soft filaments; abdomen with four segments, symmetrical. Eighth and ninth joints of anterior antennae always fused, and occasionally other joints. Outer ramus of posterior antennae 6-jointed. Blade of mandible with weak teeth; inner ramus of maxilla fused with second basal. The distal bristles of the anterior maxillipeds are modified into sac-like structures (fig. 30*b*), which occasionally are pencillate at the end; lobes of appendages closely crowded together. Inner ramus of posterior maxillipeds at most only as long as the second basal. Inner rami of swimming-feet jointed as in the *Clausocalaninae* and set with spines; fifth foot rudimentary or absent.

♂ Abdomen with shortened anal segment, number of joints of anterior antennae reduced, the twentieth and twenty-first often fused only in one. Other head appendages like those of the female, or specifically modified. Left fifth foot 5-jointed, occasionally with inner ramus, the right 4-jointed (rudiment of inner ramus sometimes present) or lacking.

1. Genus **Scolecithrix** Brady.

Undina (in part) Lubbock, 1856, p. 21.
Scolecithrix Brady, 1883, p. 56.
Scolecithrix Giesbrecht, p. 337; 1892, pp. 56, 265, 264; 1898, p. 41.
Lophothrix Giesbrecht, 1895, p. 254.
Amallophora (in part) Scott, T., 1893, p. 54.
Neoscolecithrix Canu, 1896, p. 426.
Scolecithrix Wolfenden, 1904, pp. 119, 120.

Cephalothorax ellipsoidal, head fused with thorax, abdomen of female with four segments, of male with five; anal segment commonly short. Anterior antennae in female 19- to 24- jointed, in male 17- to 24- jointed, end joints (24 and 25) fused or distinct, aesthetasks well developed, more numerous in male. Biting part of mandible and maxilla rather weak, inner ramus of maxilla mostly unsegmented and fused with the second basal. Distal bristles of anterior maxilliped thick, soft, in appearance something like the aesthetasks of the antennae; these may be vermiform, end in tufts (pencillate), or be pestle-shaped, and are usually present in both sexes. Head appendages of male like those of the female, but may in special cases be modified in particular ways. Outer rami of first four feet 3-jointed, inner ramus of first foot 1-jointed, of second 2-jointed, of third and fourth 3-jointed; surfaces of both often set with spines and points. Fifth foot in female uniramous, 1- to 3-jointed, seldom absent; fifth foot of male uniramous on each side, or the left biramous and the right uniramous, or both biramous.

KEY TO SPECIES.

1. Head without crest 2
1. Head with crest (fig. 28*a*) 4
2. Anterior antennae of female 19-jointed; right of the male 17-, the left 18-jointed 3
2. Anterior antennae of female 23-jointed..... **S. subdentata**
2. Number of joints unknown; for characters compare description and fig. 30 ..... **S. pacifica**
3. First joint of outer ramus of first foot with a thorn-like bristle on outer margin (fig. 26*c*) ..... **S. danae**
3. This joint without the bristle ..... **S. bradyi**
4. Anterior antennae of female 23-jointed; fifth foot (fig. 26*e*); right antenna of male 17-jointed, left 18-jointed; fifth foot (figs. 26*c*, *d*) ..... **S. persecans**

1. **Scolecithrix danae** Lubbock.

Undina danae Lubbock, 1856, p. 21, pl. 4, figs. 6-9.
Scolecithrix danae Brady, 1883, p. 57, pl. 17, figs. 1-12.
Scolecithrix danae Giesbrecht, 1888, p. 333; 1892, pp. 265, 283, pl. pl. 13, figs. 4, 9, 14, 17; pl. 37, fig. 6; 1898, p. 42.

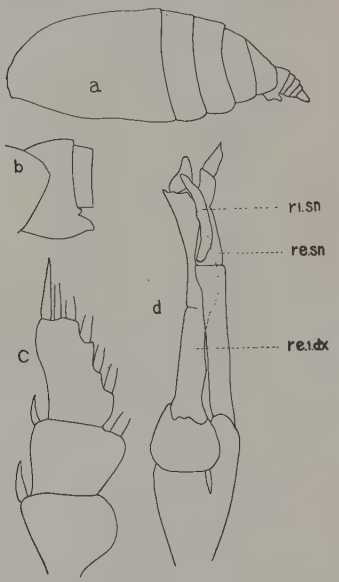

Fig. 26.—*Scolecithrix danae.* (*a*) Female, lateral, ×20. (*b*) Genital segment, female, lateral, ×83. (*c*) Outer ramus of first foot of female ×140. (*d*) Fifth foot of male ×83. *Re.*1 *dx.*, first joint of outer ramus of right foot. *Re.sn.*, outer ramus of left foot. *Ri.sn.*, inner ramus of left foot.

♀ Fourth thoracic segment separate from fifth, latter with rather flat, rounded lateral angles. Third and fourth segments of the abdomen broader than long, genital segment with ventral, shovel-shaped process (fig. 26*b*), anal segment short. Anterior antennae with nineteen segments, reaching beyond posterior border of the thorax but little. Outer ramus of posterior antennae 9/7 as long as the inner ramus, seventh joint of outer ramus without proximal bristle. Second basal of maxilla with five, inner ramus with six, outer with five bristles (cf. fig. 29*c*). First

basal of fourth pair without inner marginal bristle, first joint of outer ramus of first pair (fig. 26*c*) with outer marginal bristle. Fifth pair of feet absent.

♂ Mouth parts not retrograded; left fifth foot biramous, right uniramous, terminal joint very short (fig. 26*d*).

Coloration: In formalin, both males and females have a light red or pink color.

Length: Both sexes, 2-2.2 mm.

Occurrence: June 28, 1904, one female; December 29, 1903, one female, surface tow at 2 a.m. One male, October 20, 1904.

2. **Scolecithrix bradyi** Giesbrecht.

Scolecithrix bradyi Giesbrecht, 1888, p. 337; 1892, pp. 266, 283, pl. 4, fig. 7; pl. 13, figs. 1, 3, 7, 11, 21, 28; pl. 37, figs. 1, 2, 9; 1898, p. 42.

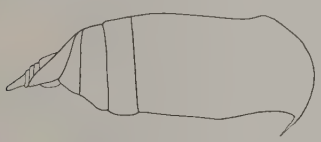

Fig. 27.—*Scolecithrix bradyi.* Female ×31.

♀ Line of separation between fourth and fifth thoracic segments visible only on the back; lateral portions of last thoracic segment elongated into two flaps, on the right more than on the left. Third and fourth segments of the abdomen much broader than long, genital segment asymmetrical, anal segment as long as the preceding ones, furca twice as long as broad. Anterior antennae 19-jointed, not reaching the posterior end of the thorax. Outer ramus of posterior antennae longer than the inner, seventh joint of the outer ramus without a proximal bristle. Maxilla as in *S. danae,* except that outer ramus has four bristles. First basal of fourth pair without bristle on inner margin, first joint of outer ramus of first pair without outer marginal bristle; fifth foot very small.

♂ Right anterior antennae with 18 joints, left with 17. Left fifth foot longer than the right by the last joint. Third joint of the outer ramus of the right large and with a prong.

Coloration: Yellowish pigment in body, mouth region, and on feet.

Length: Female, 1.4 mm.
Occurrence: June 14, 1904, one female.

3. **Scolecithrix persecans** Giesbrecht.

Scolecithrix persecans Giesbrecht, 1895, p. 253, pl. 3, figs. 6-12; 1898, p. 48, fig. 9.

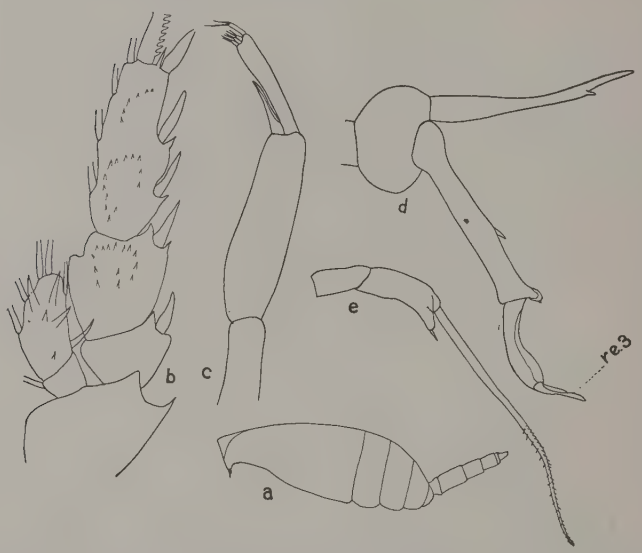

Fig. 28.—*Scolecithrix persecans.* (*a*) Male, lateral, ×9. (*b*) Second foot, male, ×45. (*c*) Left fifth foot of male ×83. (*d*) Right fifth foot, male, ×83. *Re.*3, third joint of outer ramus. (*e*) Fifth foot of female.

♂ Head with rather high crest (fig. 28*a*), last two thoracic segments fused; left anterior antenna 18-jointed, right 17-jointed, reaching beyond cephalothorax. Outer ramus of posterior antennae at least 1¼ times as long as inner; second basal of maxilla with five, outer ramus with eight, inner with seven bristles, appendages of anterior maxilliped in part pencillate. First basal of fourth foot with feathered inner border; middle of outer border of first basal of second and third feet with a small tooth, outer border of second basal of second to fourth feet with a tooth (fig. 28*b*); spines on outer margin of the two prox-

imal joints of outer ramus of first foot shorter and more slender than on the third joint; terminal saw of outer ramus of third foot indented at base, inner ramus of foot with three spines on posterior surface of second and joints; no spines on posterior surface of inner ramus of fourth foot. Anterior surface of outer ramus of second to fourth feet without spines, few on the anterior face of the inner ramus. Fifth foot fig. 28*c*, *d*.

♀ Anterior antennae 23-jointed, reaching to end of furca; abdomen symmetrical, ventral surface of genital segment convex. Posterior antennae mandible, maxilla and maxilliped and swimming feet as in the male. Fifth foot symmetrical, rather well developed (fig. 28*e*).

Coloration: Opaque white in formation, eye spots red.

Length: Male, 5.3 mm.; female, 4.6 mm. Giesbrecht gives the length of the male as 4.5 mm.

Occurrence: Two males, one female collected at San Diego, May 31, 1904; obtained also May 18 and June 23, 1904.

The female was not obtained by Giesbrecht, and has not since then been described, as far as I am aware. There can be little doubt that the outer ramus of the right fifth foot in the male is 3-jointed, and that the terminal joint in Giesbrecht's single specimen was broken off. I have seen a considerable number of males, and in all the outer ramus is 3-jointed as shown (fig. 28*d*).

4. **Scolecithrix subdentata** n. sp.

♀ Last two thoracic segments fused, each side with a small indentation in the lateral margin. Anterior antennae 23-jointed, not much longer than the cephalothorax. Inner ramus of the posterior antenna ¾ as long as the outer; second basal of maxilla with four bristles, rami each with five (fig. 29*c*). Appendages of anterior maxilliped vermiform. First basal of fourth foot with a small, non-plumose bristle on inner margin; inner marginal bristle of second basal of third and fourth pairs long and plumose; outer margin of first basal of first, second and third pairs with a small tooth in the middle, inner margin with prominent rounded process bearing the inner marginal bristle. First joint of outer ramus of first pair with outer marginal bristle. Fifth foot 2-jointed, leaf-like; terminal joint broad, oval, with

a short distal spine on the outer border, and a longer proximal spine in the middle of the outer border (fig. 29*b*).

♂ Unknown.

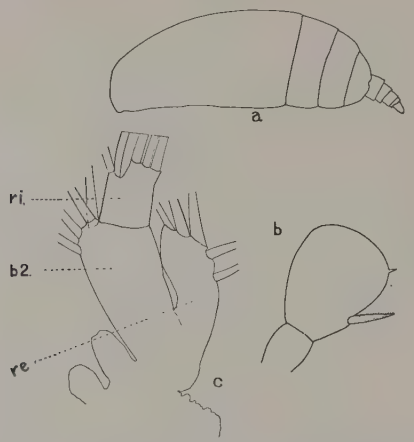

Fig. 29.—*Scolecithrix subdentata, n. sp.* (*a*) Female, lateral, ×31. (*b*) Fifth foot, female, ×195. (*c*) Maxilla ×140. *B.2*, second basal. *Ri.*, inner ramus. *Re.*, outer ramus.

Approaches *S. dentata* Giesbrecht in form of last thoracic segment, but the indentation is not as deep as in that species. The fifth foot is much as in *dentata*, but more oval and rounded. Distinct from *dentata* in possessing an outer marginal bristle on the first joint of outer ramus of first foot, and in the number of joints of the anterior antennae. The bristles of the maxilla distinguish *S. subdentata* most sharply. *S. subdentata* has the same number of joints in the antenna as *S. longicornis* Scott and *S. auropecten* Giesbrecht.

Length: Female, 1.48 mm.

Occurrence: San Diego, May 31, June 14, June 23, 1904.

5. **Scolecithrix pacifica** n. sp.

♀ Fourth and fifth thoracic segments fused, rounded laterally. First segment of abdomen about as long as second and third together; the latter two are equal in length. Outer ramus of posterior antenna a little longer than the inner ramus. Second basal of maxilla with five bristles, inner ramus with eight,

outer with five (fig. 30*d*). First basals of fourth feet without inner marginal bristle, inner border of second basal in second to fourth pairs ending in a sharp point. First joint of outer ramus of first foot with short, curved outer marginal bristle; first joint of outer ramus of fourth pair without outer marginal bristle. Fifth foot (fig. 30*c*) 2-jointed, with a short distal bristle and a very long proximal one.

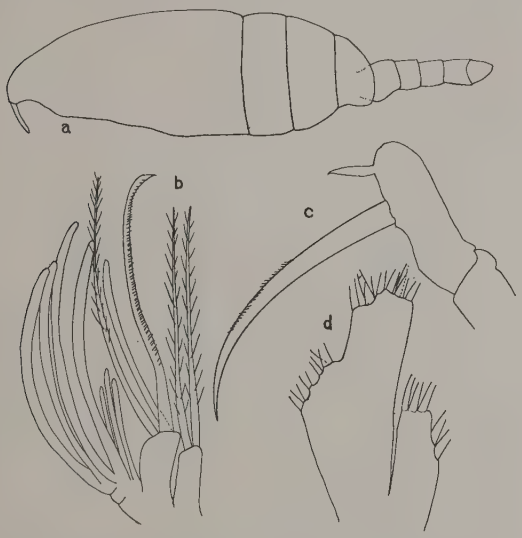

Fig. 30.—*Scolecithrix pacifica, n. sp.* (*a*) Female, lateral, ×31. (*b*) Anterior maxilliped ×140. (*c*) Fifth foot ×195. (*d*) Maxilla ×83, parts as in fig. 29*c*.

♂ Unknown.

This specimen approaches *S. porrecta* closely in general character, but is distinct in the length of the rami of the posterior antennae, form of the maxilla, bristle on outer margin of first joint of the outer ramus of the first foot, and in the form of the fifth feet. The anterior antennae are broken, but have probably not over twenty joints.

Length: Female, 2.3 mm.

Occurrence: June 23, 1904, San Diego, one female.

6. **Scolecithrix similis** T. Scott.

Amallophora dubia var. *similis* Scott, T., 1893, p. 56, pl. 4, figs. 19-23.
Scolecithrix similis Giesbrecht, 1898, p. 46.
S. similis (?) Wolfenden, 1904, p. 119, pl. 9, figs. 5, 6.

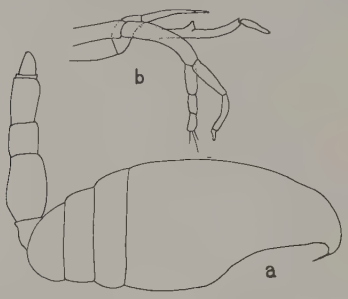

Fig. 31.—*Scolecithrix similis.* (*a*) Male, lateral, ×31. (*b*) Fifth foot, male, ×45.

♂ First abdominal segment short, second long, twice the length of the third, which is shorter than the fourth. Right anterior antenna 18-jointed, left 23-jointed (Scott). Last two thoracic segments fused. First basal of fourth foot with a plumose inner marginal bristle; both feet of fifth pair biramous (fig. 31*b*).

Length: Male, 2.6 mm.

Occurrence: San Diego, June 23, 1904.

The antennae of the single specimen were broken, but the form of the abdomen and fifth feet warrant one in identifying it with Scott's species, at least provisionally.

Fam. CENTROPAGIDAE.

Centropagidae Giesbrecht, 1892, p. 58; 1898, p. 52.

♀ Head always distinct from thorax; rostrum with two, usually soft, filaments, sometimes plumose. Anterior antennae as in the *Calanidae,* but the second joint is more often divided into two parts, never less than twenty-three joints. Outer ramus of posterior antennae at least ⅔ as long as the inner. The succeeding four pairs of appendages as in *Calanus* and like forms. In the three anterior ones are found peculiarities (in the *Hete-*

rorhabdinae) : stunting of the second and third inner marginal lobes of the maxilla through lengthening of outer ramus; preponderance of distal bristles of anterior maxilliped over the proximal. The four anterior pairs of feet with 3-jointed rami; but in *Temora* the number of joints is reduced through fusion. The fifth pair of feet is like the others (inner marginal bristle of second joint of outer ramus of special form, sword-shaped, awl- or thorn- like) or rudimentary, inner ramus 1-jointed or lacking, outer ramus 1- to 3-jointed.

♂ Abdomen with five segments, anal segment rarely shortened; genital orifice and grasping antenna on opposite sides of the body. Grasping antenna right or left, joints 19 to 21, and 22 to 23 fused. Both feet of fifth pair present, inner rami complete or reduced to absence; outer rami forming hooks or forceps. Slight sexual differences occasionally in form of last thoracic segment and swimming feet.

Sub-fam. Centropaginae.

Centropagina Giesbrecht, 1892, p. 59.

♀ Cephalothorax with six segments, abdomen with three; rostral filaments soft. Anterior antennae (24th and 25th joints fused), mandibles and maxilla as in *Calanus;* the length of the distal curved bristles of the anterior maxillipeds and the heavily bristled first basal of the posterior maxillipeds is characteristic. All five pairs of feet with 3-jointed rami.

♂ Grasping antenna on the right side; outer ramus of left fifth foot 2-jointed; the right foot with forceps.

1. Genus **Centropages** Kröyer.

Centropages Kröyer, 1849, p. 602.
Catopia Dana, 1848, p. 25; 1849, p. 280; 1852, p. 1172.
Hemicalanus Dana, 1852, p. 1103.
Ichthyophorba Lilljeborg, 1853, p. 184.
Diaptomus Lubbock, 1857, p. 403.
Ichthyophorba Claus, 1863, p. 198.
Centropages Brady, 1883, p. 81.
Centropages Giesbrecht, 1892, pp. 59, 303, 731; 1898, p. 53.
Centropages Wheeler, 1899, p. 172.
Centropages Thompson and Scott, 1903, p. 247, pl. 1, figs. 19-25.

♀ Head separate from thorax, fourth thoracic segment from fifth. Abdomen with three segments, genital segment asymmet-

rical. Anterior antennae 24-jointed; joints 24 and 25 fused. Outer ramus of posterior antennae 7-jointed and almost 1½ times as long as the inner ramus. The distal bristles of the anterior maxillipeds sickle-shaped, with spinous feathering, and much longer and thicker than the proximal bristles. First basal of the posterior maxillipeds with strongly protruding lobes, both the middle ones set with bristles, which have a spinous feathering; inner ramus well developed, 5-jointed. Rami of swimming feet usually 3-jointed, but the inner ramus is exceptionally 2-jointed. First basal with bristle on inner border in first to fourth feet, second basal thus equipped in the first pair. First basal of fifth pair without inner marginal bristle; inner marginal bristle of second joint of outer ramus thorn-like and fused with the joint (fig. 32*c*.)

♂ Sexual peculiarities in the form of the abdomen, right anterior antenna, and fifth pair of feet. The abdomen is composed of five segments; anal segment in most species very short; genital opening on the left. Right anterior antenna a grasping organ. Joints 19-21 and 22-23 fused, geniculation between the 18th and 19th. Inner marginal bristles lacking on outer ramus of left fifth foot, joints 2 and 3 fused. The outer ramus of the right foot 3-jointed, both distal joints metamorphosed into a forceps, one blade of which is the terminal joint, while the other is the thickened inner marginal bristle of the second joint.

1. **Centropages bradyi** Wheeler.

Centropages violaceus Brady, 1883, p. 83, pl. 37, figs. 1-14.
Centropages bradyi Wheeler, 1899, p. 174, fig. 12.

♀ Second joint of outer ramus of fifth foot with a stout smooth spine (fig. 32*c*). Sides of inflated genital segment without spines or knob-shaped projections. Furca symmetrical, with a peculiar short, truncated, peg-shaped projection (fig. 32*b*) between insertions of the two outer bristles. (Wheeler, 1899).

♂ Joint 17 of right anterior antenna with smooth anterior border, not serrate; joints 19 and 20 fused, separated from joint 21; joint 18 with accessory series of teeth on lower surface (Wheeler, 1899).

Coloration: Opaque, with a large purplish spot in middle of body.

Length: Female, thorax, 1.6 mm.; abdomen ?

Occurrence: June 10, 1904, one female.

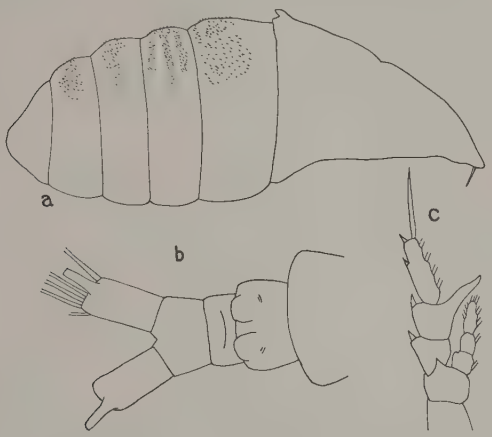

Fig. 32.—*Centropages bradyi.* (*a*) Female, thorax, lateral, ×45. (*b*) Abdomen, ventral, after Wheeler 1899. (*c*) Fifth foot ×83.

Wheeler, 1899, p. 174, does not mention the spine-like protuberance on the dorsal surface of the first segment of the cephalothorax in the female, but since the other characters as given by him (especially the furca) agree with the San Diego specimen, I have not made a new species of the latter. This agrees in possessing the dorsal spine, with *C. dorsispinatus* (Thompson, 1903, p. 247, pl. 1, figs. 19-25), but differs widely in other respects.

Sub-fam. Temorinae.

Temorina Giesbrecht, 1892, p. 60.

♀ Cephalothorax with five segments; fourth and fifth thoracic segments fused; rostral filaments soft, sometimes plumose. Anterior antennae 23- or 24-jointed; the second joint is either not divided, or, if it is divided into two parts, the proximal portion is fused with the first joint. Outer ramus of posterior antennae 7-jointed, and, with the following four appendages, is

like those of the *Calanidae*. The first four pairs of feet usually with 3-jointed rami, in which, however, the two proximal joints may be fused; inner ramus absent in fifth pair, or small and 1-jointed; the outer ramus is 1- to 3-jointed.

♂ Grasping antenna usually the right; distally from the geniculation, the nineteenth and twenty-first and twenty-second and twenty-third joints are fused; sexual peculiarities often in the swimming feet as well as in the form of the body, anterior antennae and fifth pair of feet.

1. Genus **Pleuromamma** Giesbrecht.

Diaptomus Lubbock, 1856, p. 27.
Pleuromma Claus, 1863, p. 195.
Pleuromma Brady, 1883, p. 45.
Pleuromma Giesbrecht, 1892, pp. 61, 347, 757.
Pleuromma Dahl, 1893, p. 105.
Pleuromma Wheeler, 1899, p. 176.
Pleuromamma Giesbrecht, 1898, p. 108.

Easily recognizable by a dark-pigmented knob on the right or left side of the first thoracic segment (figs. 33*a*, 34*a*). Furca at most twice as long as broad. Rami of the first to fourth pairs of feet 3-jointed, first joint of outer ramus of third pair with a deep notch in the outer border; terminal bristle of outer ramus of third pair short and bent outward; first joint of inner ramus of second pair with hooks on inner border, on right and left foot in the female, usually on one side in male. Fifth pair in female rudimentary, 2- to 4-jointed, in male 5-jointed on each side, without forceps. Grasping antenna of male on right or left side. Abdomen of female with three segments; of male with five, sometimes asymmetrical.

1. **Pleuromamma abdominalis** Lubbock.

Diaptomus abdominale Lubbock, 1856, p. 28, pl. 10, figs. 1-8.
Pleuromma abdominale Claus, 1863, p. 197, pl. 5, figs. 1-6, 13, 14; pl. 6, fig. 1-10.
Pleuromma abdominale Brady, 1883, p. 46, pl. 11, figs. 1-13.
Pleuromma abdominale Giesbrecht, 1892, pp. 347, 357, pl. 5, fig. 8; pl. 32, figs. 3, 5, 13, 22, 25-30; pl. 33, figs. 43, 44, 48, 49, 52.
Pleuromamma abdominalis Giesbrecht, 1898, p. 109.

♀ Pigment knob on right or left side; proximal joint of first antenna with several smaller and two larger (one straight and one curved) teeth on anterior border. Fifth pair of feet 4-jointed, with three apical bristles (fig. 33*b*).

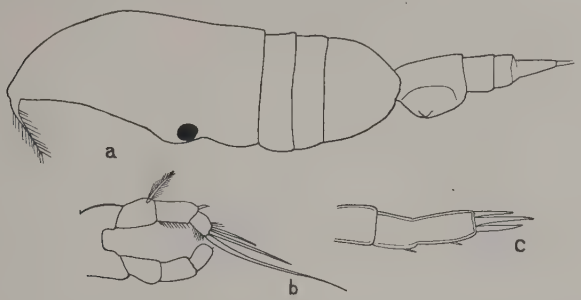

Fig. 33.—*Pleuromamma abdominalis* and *P. gracilis*. (*a*) *P.a.*, female, lateral, ×31. (*b*) *P.a.*, fifth foot ×45. (*c*) *P.g.*, fifth foot ×195.

♂ Pigment knob, genital opening and hooks on inner border of first joint of inner ramus of second foot, on left side. Proximal joint of anterior antennae with small teeth only, grasping antenna on right side. Abdomen symmetrical. End joint of left fifth foot broadened.

Coloration: Transparent, except for a small amount of red in the mouth region.

Length: Female, about 2.4-3 mm.; male, 3.3 mm.

Occurrence: A common species, both summer and winter, but males are very infrequently found; one male was taken June 2, 1904.

2. **Pleuromamma gracilis** Claus.

Pleuromma gracile Claus, 1863, p. 197, pl. 5, figs. 7-11.
Pleuromma abdominale (in part) Brady, 1883, p. 47, pl. 2, figs. 1-16; pl. 21, figs. 13, 14.
Pleuromma gracile Giesbrecht, 1892, pp. 347, 357, pl. 5, fig. 7; pl. 32, figs. 6, 18-20; pl. 33, fig. 41-47.
Pleuromamma gracilis Giesbrecht, 1898, p. 110.

♀ Pigment knob on right side; anterior border of anterior antennae with only small teeth; fifth pair of feet 2-jointed, three prongs at the end (fig. 33*c*).

♂ Pigment knob on right side; abdomen symmetrical; anterior antennae as in female as regards armature; grasping antenna on left side; first joint of inner ramus of second foot with hooks only on right side; third and fourth feet as in female.

Coloration: As in *P. abdominalis.*

Length: Both sexes, 1-2 mm.

Occurrence: More abundant than *P. abdominalis,* but males are rare.

Brady, 1883, p. 47, considers that *P. gracilis* Claus is an immature form of *P. abdominalis* Claus, but Giesbrecht, 1892, does not favor this view, and the San Diego specimens of *P. gracilis* present such differences when compared with *P. abdominalis* that there can be no doubt of the distinctness of the species. The forms represented by *P. gracilis* are without doubt mature, since females are often found with attached spermatophores.

3. **Pleuromamma xiphias** Giesbrecht.

Pleuromma xiphias Giesbrecht, 1889, p. 6; 1892, pp. 347, 367, pl. 32, fig. 14; pl. 33, figs. 42, 45, 50.

Pleuromamma xiphias Giesbrecht, 1898, p. 110.

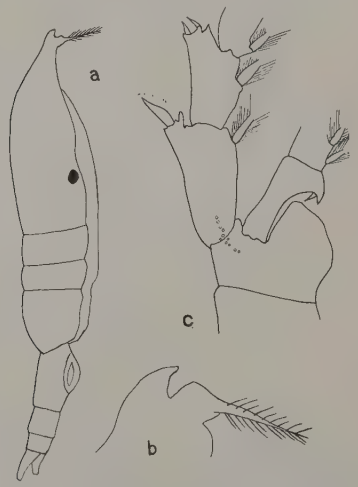

Fig. 34.—*Pleuromamma xiphias.* (*a*) Female, lateral, ×18. (*b*) Head of female, lateral, ×48. (*c*) Second basal, and proximal joints of rami of second foot, ×48.

Allied to *P. abdominalis,* but the front of the head anterior to the rostrum is prolonged into a prominent process (fig. 34*b*).

Coloration: As in the other species.

Length: Female, 4.1-4.5 mm.

Occurrence: San Diego, July 31, 1903, one female; June 23, 1904, one female; taken also December 23, 1903, on "Banks." The occurrence of the male is uncertain; large male animals have been taken with the characteristic shape of *xiphias,* but I cannot say definitely whether they belong to this species or not.

2. Genus **Metridia** Boeck.

Metridia Boeck, 1864, p. 13.
Paracalanus Brady and Robertson, 1878, p. 126.
Metridia Giesbrecht, 1892, pp. 61, 339, 749; 1897, p. 254; 1898, p. 105.
Metridia Dahl, 1894*a*, p. 10.
Metridia Wheeler, 1899, p. 175.
Metridia Wolfenden, 1904, p. 125.
(See also T. Scott, 1893, p. 42, pl. 3, figs. 8-20.)

Closely allied to *Pleuromamma,* but is without the lateral pigment knob. Terminal bristle of outer ramus of third pair of normal form; swimming feet of the male (especially the second pair) corresponding with those of the female. Furca 2 to 5 times as long as broad.

1. **Metridia lucens** Boeck.

Metridia lucens Boeck, 1864, p. 14.
Paracalanus hibernicus Brady and Robertson, 1873, p. 126, pl. 8, figs. 1-3.
Metridia armata Brady, 1878, p. 42.
Metridia hibernica Giesbrecht, 1892, pp. 340, 357, pl. 33, figs. 2, 12, 16, 22, 28, 36, 39.
Metridia lucens Dahl, 1894, p. 11.
Metridia lucens Giesbrecht, 1898, p. 106.

♀ Cephalothorax 1⅔ times as long as the abdomen; lateral angles of fifth thoracic segment slightly pointed. Genital segment somewhat shorter than the two last abdominal segments together, the anal segment about ¾ as long as the preceding. Furca shorter than the last abdominal segment and twice as long as broad. The anterior antennae reach back hardly to posterior margin of the genital segment. Terminal bristle of end joint of outer ramus of fourth foot little over ¼ as long

as the joint. Fifth foot 3-jointed and with three rather long bristles on end joint (fig. 35*c*).

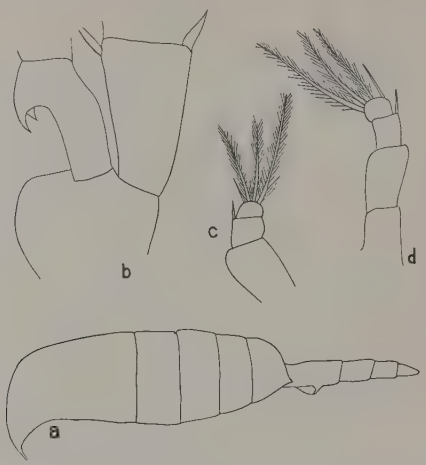

Fig. 35.—*Metridia lucens* and *M. boeckii*. (*a*) *M.l.*, female, lateral, ×20. (*b*) *M.l.*, second basal and first joint of inner ramus of second foot of female to show hooks, ×195. (*c*) *M.l.*, fifth foot of female ×195. (*d*) *M.b.*, fifth foot of female ×195.

♂ Grasping antenna on right side. Fifth foot: second joint of outer ramus of left foot without, first joint of outer ramus of right foot with a long, thorn-like bristle.

Length: Female, 3.2 mm.

Occurrence: Very common, summer and winter.

2. **Metridia boeckii** Giesbrecht.

Metridia boeckii Giesbrecht, 1889, p. 5; 1892, pp. 340, 346, pl. 33, figs. 8, 19, 31, 37; 1898, p. 107.

♀ Like *M. lucens*, but furca is as long as the fifth abdominal segment, and twice as long as broad. Anterior antennae reach a little beyond the posterior border of the thorax. Fifth foot with four joints (fig. 35*d*).

♂ Unknown.

Length: Female, 2.5 mm.

Occurrence: One or two in catches with *M. lucens*.

It should be noted that not a male specimen of *Metridia* has been taken in any catch, so far as I have examined them, and rather particular attention has been paid to this point.

Sub-fam. Lucicutiinae.

Leuckartiina Giesbrecht, 1892, p. 62.

♀ Cephalothorax with five segments, fourth and fifth thoracic segments fused, rostral filaments thin and usually soft; abdomen with four segments, symmetrical. The second joint of the anterior antenna is divided, and the twenty-fourth joint is separate from the twenty-fifth. Outer ramus of posterior antennae 8-jointed, the four following appendages like those in the *Calanidae*. The first four pairs of feet almost always with 3-jointed rami, the fifth pair like the preceding ones and that of *Centropages*, with 3-jointed outer ramus and 2- to 3-jointed inner ramus.

♂ (Known only in *Lucicutia*.) Grasping antenna the left; distal to the geniculation the nineteenth to twenty-first, and twenty-second and twenty-third joints are fused; fifth pair of feet without forceps, basals 2-jointed, the right with 2-, the left with 3-jointed rami; no other sexual differences except in form of body.

1. Genus **Lucicutia** Giesbrecht.

Leuckartia Claus, 1863, p. 182.
Leuckartia (in part) Brady, 1883, p. 50.
Leuckartia Giesbrecht, 1892, pp. 62, 358; 1895, p. 258.
Lucicutia Giesbrecht, 1898, p. 110.
Lucicutia Steuer, 1904, p. 596.
Lucicutia Wolfenden, 1904, p. 121.

Head broad; furca symmetrical. First lobe on outer border of maxilla with five bristles.

♀ Five segments in cephalothorax, abdomen with four, symmetrical. Rostral filaments slender, situated on a papilla. Posterior antennae like those of *Centropages*, but with eight joints in outer ramus. Blade of mandible weakly built, outer ramus bent rather far proximally. Outer border lobes of maxilla with only five bristles; inner border lobes well developed, the proximal one, however, with weak masticatory bristles. Inner ramus 2-jointed, articulated with basal; outer ramus large, oval. Distal

bristles of maxillipeds little longer than the proximal; bristles of outer border of posterior maxilliped slender, without hairs. Outer rami of the five pairs of feet 3-jointed; inner ramus of first pair 2-jointed (second and third joints fused), of second to fifth pairs 3-jointed; first basal with bristle on inner margin in second to fourth pairs, second basal in first pair with inner marginal bristle, and sometimes with a tube-like process. The bristle on the inner margin of the second joint of the outer ramus of the fifth pair has the form of a curved awl (fig. 36*b*).

♂ Sexual peculiarities in the form of the abdomen, posterior antennae and fifth pairs of feet. Abdomen with five segments, genital opening on right side. The left antenna is a grasping organ, geniculating between joints 18 and 19; joints 19 to 21, 22 and 23 fused. Fifth pair of feet with 2-jointed basals; rami of left foot 2-jointed, of right 3-jointed. The distal joint of the outer ramus of the right foot is hooked and may be moved toward the proximal joints.

1. **Lucicutia flavicornis** Claus.

Leuckartia flavicornis Claus, 1863, p. 183, pl. 32, fig. 17.
Leuckartia flavicornis Giesbrecht, 1892, p. 358, pl. 5, fig. 4; pl. 19, figs. 2, 3, 15, 17, 21, 23, 29, 38; pl. 38, fig. 38, 40.
Lucicutia flavicornis Giesbrecht, 1898, p. 111.

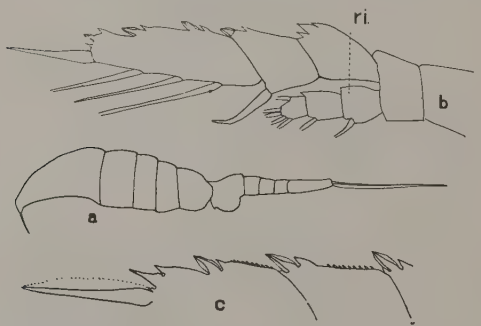

Fig. 36.—*Lucicutia flavicornis.* (*a*) Female, lateral, ×18. (*b*) Fifth foot, female, ×83. *Ri.*, inner ramus. (*c*) Outer margin of outer ramus of third foot ×140.

♀ Anal segment shorter than the preceding; second terminal bristle of furca thick, twice as long as abdomen. The anterior an-

tennae reach beyond middle of the furca, joint 19 as long as tenth to twelfth, inclusive. Second basal of maxilla with four bristles. Inner ramus of first pair of feet 3-jointed, with eight bristles; inner ramus of fifth pair reaches almost to the distal border of the second joint of the outer ramus; first joint of outer ramus much shorter than the third, which is twice as long as the terminal bristle.

♂ Terminal portion of grasping antenna (joints 19-25) somewhat longer than joints 14-18. Inner ramus of right foot of fifth pair straight, with five bristles, which are at the end of the terminal joint.

Coloration: Transparent, with light yellowish pigment in various locations. The San Diego specimens showed this to a very small extent.

Length: Female, 1.6 mm.; male a little less.

Occurrence: June 8, 1904, one male, one female; June 10, 1904, one male (?).

Sub-fam. Heterorhabdinae.

Heterochaetina Giesbrecht, 1892, p. 63.

Cephalothorax with five segments; fourth fused with fifth thoracic segment; rostral filaments slender, sometimes plumose; last thoracic segment in some cases with pointed lateral angles. Abdomen with three or four segments, not always symmetrical. Second joint of anterior antennae divided, the two terminal joints usually distinct. Second joint of outer ramus of posterior antennae divided into two, so that there are as a result eight joints in the ramus (which, however, may be reduced by fusions). Blade of mandible with few teeth, inner ramus small, sometimes lacking. Inner ramus and both distal lobes of inner margin of maxilla small, occasionally absent; outer ramus always present, and usually much lengthened. Anterior maxilliped elongate, lobes small, the proximal ones usually rudimentary; bristles of distal lobes, and usually those of the inner ramus, almost always long, thick and hooked. The four anterior pairs of feet with 3-jointed rami, fifth pair like the others, rami almost without exception 3-jointed.

♂ Sexual differences in form of body, anterior antennae, fifth pair of feet, seldom in structure of mouth parts. Grasping an-

tenna usually the left; first and second joints fused, as well as the nineteenth to twenty-first, twenty-second and twenty-third (or twenty-second to twenty-fifth); fifth pair of feet with 3-jointed outer and 1- to 3-jointed inner ramus; forceps incomplete or absent.

1. Genus **Heterorhabdus** Giesbrecht.

Heterochaeta Claus, 1863, p. 180.
Heterochaeta Brady, 1883, p. 48.
Heterochaeta Giesbrecht, 1892, pp. 64, 372, 745; 1895, p. 259.
Heterochaeta, Aurivillius, 1899, p. 38, figs. 4, 5.
Heterorhabdus Giesbrecht, 1898, p. 113.
Heterorhabdus Wolfenden, 1904, p. 124.

♀ Cephalothorax with five segments, rostral filaments soft, situated on a papilla. Abdomen with four segments, left half of furca not articulating with anal segment, larger than the right and with much longer bristles. Rami of posterior antennae about equal in length, outer ramus with eight bristles. Anterior maxilliped straight, terminal portion and proximal lobes with their bristles strongly suppressed, while the distal lobes are provided with strong hooked bristles. Posterior maxillipeds distinguished by shortness of the bristles on the inner ramus and by the length and thickness of one bristle on the inner margin of the first basal joint. All the feet have 3-jointed rami; inner marginal bristle of the first basal in pairs one to four, and of the distal basal joint in the first pair, well-developed and plumose. Terminal joint of outer ramus of third pair usually different in form from that joint in the other pairs, being broad and oval (fig. 38*d*). The inner marginal bristle of the second joint of the outer ramus of the fifth pair is thickened and sword-shaped (fig. 38*e*).

♂ Sexual peculiarities in form of posterior portion of body, left anterior antenna and fifth pair of feet. Abdomen with five segments, genital opening on right side. Grasping antenna slender. Fifth pair of feet with 3-jointed rami; terminal joints of both outer rami hooked; processes on the distal basal joint.

KEY TO SPECIES.

Abdomen 4-segmented, fifth foot symmetrical..... ♀
Abdomen 5-segmented, fifth foot asymmetrical..... ♂

1. Third joint of outer ramus of third foot of same form as in second and fourth pairs (fig. 40*a*).....**H. longicornis**

1. This joint in third pair broad and oval, terminal bristle shortened (fig. 38*d*) 2
2. First basal of posterior maxilliped with a very long, heavy bristle in the middle of the inner border; rostral papilla with a point (fig. 37*a*) ..... **H. spinifrons**
2. As above, but rostral papilla without point (figs. 38*b*, *c*) 3
3. ♀ Inner marginal bristle of second joint of inner ramus of fifth foot much shorter and more slender than those of the third joint; first joint of outer ramus with thorn-like inner marginal bristle. ♂ Fifth foot (fig. 39) ..... **H. clausi**
3. ♀ Inner marginal of second joint of inner ramus of fifth foot but little shorter than those of third joint; first joint of outer ramus without inner marginal bristles ..... **H. papilliger**

1. **Heterorhabdus spinifrons** Claus.

Heterochaeta spinifrons Claus, 1863, p. 182, pl. 32, figs. 8-9, 14, 16.

Heterochaeta spinifrons Giesbrecht, 1892, pp. 372, 382, pl. 10, figs. 1, 3, 11, 16, 19, 31; pl. 39, figs. 42, 43, 51, 52, 54.

Heterorhabdus spinifrons Giesbrecht, 1898, p. 114.

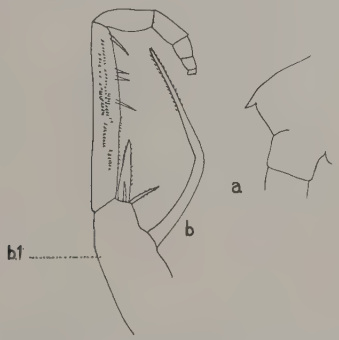

Fig. 37.—*Heterorhabdus spinifrons.* Female. (*a*) Head, lateral, ×83. (*b*) Posterior maxilliped ×167. *B.*1, first basal.

The papilla on front of head ends in a sharp point; anterior antennae reach beyond the end of the furca by the last four or five joints. The fourth lobe of the anterior maxilliped has two long, thick bristles, and a small, slender one which is hardly ¼ as long as the other two; the fifth lobe has two bristles, one of which is longer and thicker than the other. A spine-like bristle at the end of the inner margin of the first basal of the posterior maxilliped is ¼ the length of the long bristle in the middle of the margin (fig. 37*b*). Hooks at the end of both outer rami of the

fifth foot of the male relatively longer than in *H. papilliger,* the left over twice as long as the first and second joints of the outer ramus.

Coloration; Transparent and colorless.

Length: Female, 3.4 mm.

Occurrence: June 23, 1904, one female.

2. **Heterorhabdus papilliger** Claus.

Heterochaeta papilligera Claus, 1863, p. 182, pl. 3, figs. 10-13, 15.
Heterochaeta papilligera Giesbrecht, 1892, pp. 372, 382, pl. 20, figs. 4, 7, 10, 15, 17, 23, 35, 36; pl. 39, figs. 40, 53.
Heterorhabdus papilliger Giesbrecht, 1898, p. 114.

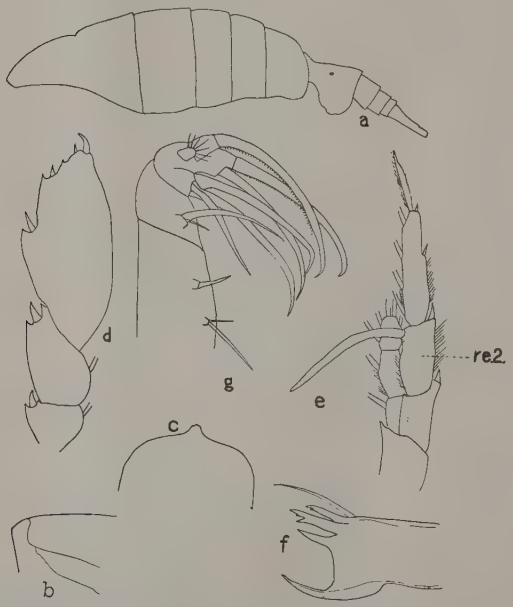

Fig. 38.—*Heterorhabdus papilliger.* (*a*) Female, lateral, ×31. (*b*) Head, female, lateral, ×83. (*c*) Head, female, dorsal, ×83. (*d*) Outer ramus of third foot of male ×83. (*e*) Fifth foot of female ×140. *Re.*2, second joint of outer ramus. (*f*) Right mandibular blade of male ×83. (*g*) Anterior maxilliped, female, ×83.

Papilla on front of head elongated but not ending in a point (figs. 38*b*, *c*). Anterior antennae when at the sides of the body reach about to the end of the furca. Fourth lobe of the anterior maxillipeds (fig. 38*g*) with two long, thick bristles and a shorter, thinner one, which is over half as long as the others; fifth lobe with two bristles of about equal length and thickness. On the end of the inner border of the first basal of the posterior maxilliped is a spine-like bristle, which is hardly one-eighth as long as the bristle in the middle of the margin, and the latter one is almost twice as long as the second basal (cf. fig. 37*b*). Hooks at the end of both outer rami of the fifth foot in the male relatively shorter than in *spinifrons*; the left little longer than the first and second joints of the outer ramus together.

Coloration: As in *spinifrons*.

Length: Female, 2.2 mm.; males slightly smaller.

Occurrence: A few specimens of both sexes were taken during May and June, 1904.

3. **Heterorhabdus clausi** Giesbrecht.

Heterochaeta clausii Giesbrecht, 1889, p. 2; 1892, pp. 372, 382, pl. 20, fig. 2, 28, 37, 38.
Heterorhabdus clausi Giesbrecht, 1898, p. 115.

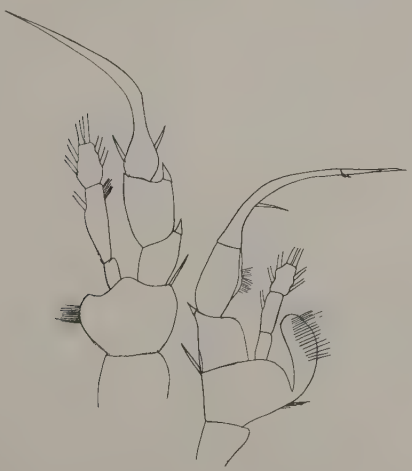

Fig. 39.—*Heterorhabdus clausi*. Fifth foot, male, ×83.

Like *papilliger*, but the anterior antennae reach somewhat beyond the end of the furca. Inner ramus of anterior maxillipeds with longer bristles; inner marginal bristle of first and second joints of inner ramus of fifth foot in the female short and slender, that of the first joint of the outer ramus thick and hooked; second basal of the right fifth foot in the male with a long lamellar process, the second joint of the outer ramus with a shorter projection on the inner border, third relatively longer, especially on the left side.

Length: Male, 2-2.5 mm.

Occurrence: San Diego, July 22, 1903, one male; June 23, 1904, one male.

4. **Heterorhabdus longicornis** Giesbrecht.

Heterochaeta longicornis Giesbrecht, 1889, p. 2; 1892, pp. 373, 383, pl. 20, figs. 14, 21, 25, 26; pl. 39, fig. 44.
Heterorhabdus longicornis Giesbrecht, 1898, p. 116.
Heterorhabdus zetesios Wolfenden, 1902, p. 367.
Heterorhabdus longicornis (male) Wolfenden, 1904, p. 124, pl. 9, fig. 34.

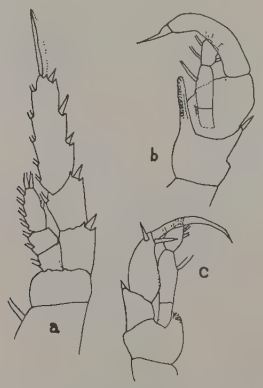

Fig. 40.—*Heterorhabdus longicornis.* Male. (*a*) Third foot ×140. (*b*) Right fifth foot ×140. (*c*) Left fifth foot ×140.

♀ Anterior antennae reach beyond the end of the furca for the last eight or nine joints; inner ramus of maxilla with five bristles, first and second inner marginal lobes relatively long; anterior maxillipeds with a greater number of bristles, but with

less strongly developed hooked bristles than in the other species; inner ramus clearly with three joints, and with seven long bristles; bristles of first basal of the posterior maxillipeds and third joint of outer ramus of third swimming foot of usual form. Inner marginal bristle of second joint of outer ramus of fifth pair more slender, and inner marginals of first and second joints thicker than in the other species, distal border of second joint of outer ramus of ordinary form.

♂ Like female in structure of maxillipeds and terminal joint of outer ramus of third and fourth swimming feet. Fifth foot (figs. 40*b*, *c*): right with stiff upright process on second basal (inner margin), covered with stiff spines, second joint of outer ramus with a projection having four teeth at end.

Length: Male, 3 mm.

Occurrence: San Diego, June 23, 1904, one male.

2. Genus **Augaptilus.**

Hemicalanus (in part) Claus, 1863, p. 176.
Augaptilus Giesbrecht, 1889, p. 3; 1892, pp. 65, 400, 724; 1898, p. 120.
(See also T. Scott, 1893, p. 36, pl. 2, figs. 25-37; Steuer, 1904, p. 597.)

♀ Cephalothorax composed of five segments; rostral filaments short and sometimes feathered. Abdomen with 3 segments, genital segment usually not wholly symmetrical. Anterior antennae 25-jointed, outer ramus of posterior antennae rarely longer than the inner ramus. Mandibular blade with two teeth (mandible sometimes uniramous and with a stylet-like blade). Inner ramus of maxilla lacking; both maxillipeds with reduced proximal lobes and peculiarly equipped bristles (cf. fig. 41*b*). Feet with spines on outer border of outer rami reduced in part, the third bristle on the inner border of the last joint of the outer ramus of the fifth foot not elongated, the inner marginal bristle of the middle joint awl-shaped or lacking; both rami 3-, rarely 2-jointed.

♂ Sexual differences in the form of the abdomen, anterior antennae and fifth feet. Abdomen with 5 segments, genital opening right or left. The right or left anterior antenna may be the grasping organ. Rami of both feet of fifth pair 3-jointed (fig. 41*c*, *d*).

1. **Augaptilus longicaudatus** Claus.

Hemicalanus longicaudatus Claus, 1863, p. 179, pl. 29, fig. 3.
Augaptilus longicaudatus Giesbrecht, 1892, p. 414, pl. 27, fig. 31; pl. 28, figs. 11, 19, 23, 31, 35, 38; pl. 2, fig. 22; pl. 39, figs. 37, 48; 1898, p. 123.
Augaptilus longicaudatus Scott, 1894, p. 34, pl. 1, figs. 24-26; pl. 2, fig. 5.

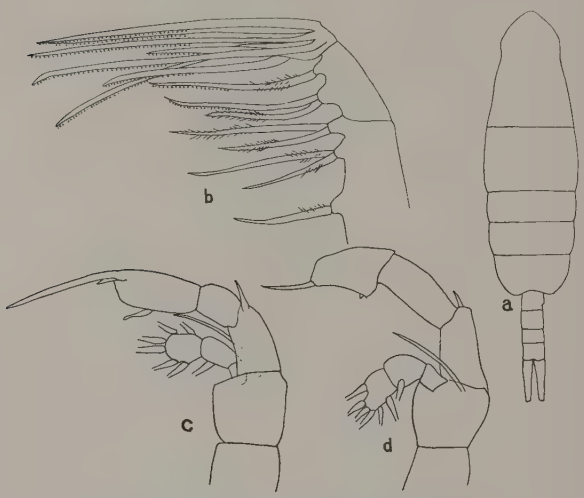

Fig. 41.—*Augaptilus longicaudatus.* Male. (*a*) Dorsal ×18. (*b*) Anterior maxilliped ×83. (*c*) Right fifth foot ×83. (*d*) Left fifth foot ×83.

♀ Genital segment not entirely symmetrical, twice as long as both the following segments together; furca as long as the anal segment, and about 5 times as long as broad. Anterior antennae longer than trunk by about the last 6 joints. Inner ramus of posterior antennae ⅓ longer than the outer ramus; first and second joints of outer ramus not fused; mandible uniramous. Anterior maxilliped: First and second lobes lacking, third with 1 bristle, fourth and fifth with 2, sixth with 1. First basal of posterior maxilliped with 0, 0, 1, 2 bristles. Length of first and second basals and inner ramus as 7:6:5. Outer ramus of fifth foot 2-jointed.

‡ Grasping antenna on left. Fifth foot, fig. 41*c*, *d*.
Coloration: Transparent, without pigment.
Length: Male, 3.39 mm.
Occurrence: June 10, 1904, 1 male.

3. Genus **Arietellus** Giesbrecht.

Arietellus Giesbrecht, 1892, pp. 66, 415.
Rhincalanus (part) T. Scott, 1893, p. 31.
Arietellus Giesbrecht, 1898, p. 124.

Last two thoracic segments fused, elongated into a strong spine on each side (fig. 42*a*), front with wedge-shaped process, rostral filaments slender. Abdomen of female with 4 segments, symmetrical; furca, and appendages with long, richly plumose bristles. Anterior antennae of female and the right one of male at most 20-jointed, joints 1 and 2, 21-25 fused; grasping antenna on the left, 19-jointed, terminal portion 2-jointed. Inner ramus of posterior antenna straight, longer than outer; mandible uniramous, inner ramus lacking; inner ramus and third inner marginal lobe of maxilla lacking, outer ramus long and characteristic. Anterior and posterior maxillipeds as in *Augaptilus* except in appendages of bristles (fig. 42*c*). Rami of first to fourth feet 3-jointed; fifth foot of female (fig. 42*b*) 3-jointed, basals 2-, outer ramus 1-jointed, inner ramus rudimentary. Fifth foot of male without forceps, basals 2-, outer ramus 3-jointed, inner ramus 1-jointed.

1. **Arietellus setosus** Giesbrecht.

Arietellus setosus Giesbrecht, 1892, p. 415, pl. 29, figs. 1, 3-7, 9-13; pl. 39, figs. 34-36; 1897, p. 254; 1898, p. 124.

With the characters of the genus.

Coloration: Terminal expansions of plumose furcal bristles red, the remaining portion black. Body orange red, bristles on posterior antennae and mouth parts, deep red.

Length: 5.5 mm.

Occurrence: One female was taken at San Diego, Dec. 22, 1903.

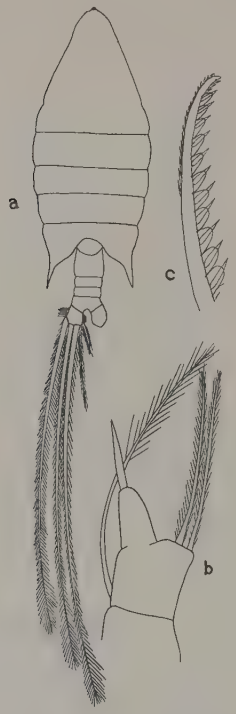

Fig. 42.—*Arietellus setosus.* Female. (*a*) Dorsal ×9. (*b*) Fifth foot ×83. (*c*) Distal portion of one of the bristles of the anterior maxilliped ×140.

4. Genus **Phyllopus** Brady.

Phyllopus Brady, 1883, p. 78.
Phyllopus Giesbrecht, 1892, pp. 66, 419; 1898, p. 124.
Phyllopus Wolfenden, 1904, p. 124.

♀ Last thoracic segment not entirely symmetrical; abdomen with 4 segments, genital segment asymmetrical. Anterior antennae with 24 joints. Inner ramus of posterior antennae about half as long as the outer ramus of 8 joints. Blade of mandible strong, with four teeth. Anterior maxillipeds elongated, posterior with short, broad first basal. First to fourth pairs of feet with 3-jointed rami, second basal with inner mar-

ginal bristle in first pair and with outer marginal in first and fourth. Fifth pair with basal of two joints and 3-jointed outer ramus. Inner ramus lacking, inner marginal bristle of middle joint of outer ramus thick and long; terminal joint shortened, its distal margin toothed (fig. 43*b*).

♂ Like female except in structure of anterior antennae and fifth feet. Abdomen with 5 segments. Left anterior antenna 20-jointed, geniculating between joints 17 and 18. Fifth feet each with 2 basals, and 3-jointed outer rami, the right foot has a rudimentary inner ramus, broad and without spines. Second basal of each foot with a long, slender plumose bristle.

1. **Phyllopus bidentatus** Brady.

Phyllopus bidentatus Brady, 1883, p. 78, pl. 5, figs. 7-16.
Phyllopus bidentatus Giesbrecht, 1892, p. 419, pl. 18, figs. 25-33; pl. 38, fig. 35; 1898, p. 124.
Phyllopus bidentatus ♂ Wolfenden, 1904, p. 124, pl. 9, fig. 16.

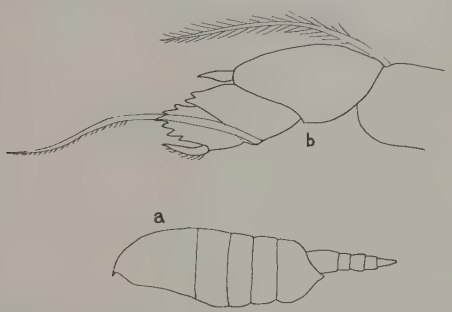

Fig. 43.—*Phyllopus bidentatus.* Female. (*a*) Lateral ×18. (*b*) Fifth foot ×195.

With the generic characters. Both Giesbrecht (1892) and Wolfenden (1904) state that the "bidentate" lateral portion of the last thoracic segment does not exist as in Brady's description. The San Diego specimen agrees with the description of the two former authors. The male of the species is described by Wolfenden as cited, and the above description is taken from him.

Coloration: Transparent, without pigment.

Length: Female, 2.2 mm.
Occurrence: San Diego, May 31, 1904, one female.

Fam. CANDACIIDAE.

Candacidae Giesbrecht, 1892, p. 67.
Candaciidae Giesbrecht, 1898, p. 126.

♀ Cephalothorax with 5 segments, rostrum absent, abdomen with 3 segments. In posterior antennae the second basal and first joint of inner ramus is fused, outer ramus slender, end joints shortened. Blade of mandible with few teeth. Second lobe of inner margin of maxilla very long, third and fourth absent. Anterior maxilliped without lobes, bristles on distal portions sickle-shaped and hooked. Posterior maxilliped as in *Calanus* but small and weak. Inner ramus of anterior pairs of feet 2-jointed; fifth pair rudimentary.

♂ Genital orifice on left; grasping antenna the left, seventeenth and eighteenth and nineteenth and twentieth joints fused; fifth foot without inner ramus, the left 4-jointed, the right 3-jointed ending in a forceps or bristle.

1. Genus **Candacia** Dana.

Candacia Dana, 1846, p. 184.
Ifionyx Kröyer, 1848-49, p. 601.
Candace Dana, 1849, p. 279; 1852, p. 1109.
Candace Lubbock, 1856, p. 29.
Candace Claus, 1863, p. 189.
Candace Streets, 1877, p. 139.
Candace Brady, 1883, p. 66
Candace Thompson, 1888*b*, p. 148.
Candace Giesbrecht, 1892, pp. 67, 423, 729.
Candace Wheeler, 1899, p. 177.
Candacia Giesbrecht, 1898, p. 126.

♀ Fourth and fifth thoracic segments fused; front of head rectangular, lateral angles of last thoracic segment pointed; abdomen with 3 segments, genital segment often asymmetrical. Anterior antennae 23- or 24-jointed, proximal segments thickened, anterior border toothed. Rami of posterior antennae short, outer ramus slender, second joint elongated, terminal ones very short. Basal of mandible large, rami short, blade with 2 teeth. Anterior maxilliped elongate, without lobes, dis-

tal bristles strong, sickle-shaped; posterior maxilliped small and weak, second basal and inner ramus suppressed. First to fourth pairs of feet with 3-jointed outer rami, inner rami relatively small, 2-jointed; first basal with inner marginal bristle in second and third pairs. Outer border of outer ramus toothed, fifth pair stunted, 3-jointed on each side.

♂ Last thoracic segment more often asymmetrical, the point on the right side noticeable for form, size, and color. Abdomen with 5 segments, genital segment often asymmetrical with outgrowths on the right side. Right anterior antenna a grasping organ. Fifth foot on right side 3-jointed, on left side 4-jointed; the right foot terminates in a forceps or bristle.

KEY TO SPECIES.

1. Terminal bristle of outer ramus of third foot with outward bent point, at least as long as the distance between the distal spines of the outer border of the joint (fig. 44*c*) 2
1. This bristle much shorter than the designated portion of the outer border (fig. 47*d*) .....
2. Genital segment of female longer than broad.....**C. pectinata**
2. Genital segment of female broader than long, male not known.. ..... **C. bipinnata**
3. The thick proximal portion of the anterior antennae is 7-jointed (fig. 45*b*) 4
3. This portion 6-jointed 5
4. Terminal joint of fifth foot of female without bristles on inner border; joint of grasping antenna proximal to geniculation with deep teeth on anterior border. Fifth foot of male (fig. 46*c*) ..... **C. curta**
4. Terminal joint of fifth foot of female with three bristles, apical teeth slender and sharp. Teeth on grasping antenna fine; genital segment with flat outgrowth on right side; (fig. 47*b*).. ..... **C. aethiopica**

1. **Candacia pectinata** Brady.

Candace pectinata Brady, 1878, p. 49; 1883, p. 67, pl. 30, figs. 1-13.

Candace pectinata Giesbrecht, 1892, pp. 424, 439, pl. 4, fig. 3; pl. 21, figs. 2, 12; pl. 22, figs. 9, 17, 18, 31, 43-46; pl. 39, figs. 1, 21, 22, 24, 25.

Candacia pectinata Giesbrecht, 1898, p. 128.

Candace pectinata Wheeler, 1899, p. 177, fig. 15.

Genital and following segment in female asymmetrical, the latter protruding posteriorly; last thoracic segment in the male

asymmetrical. Anterior antennae with 23 joints, pectinate part of joints of grasping antenna deeply toothed, the segments on either side of the articulation suppressed. Proximal hooked bristles of second basal of anterior maxilliped as thick and almost as long as the distal ones. Terminal joint of fifth foot of female long and claw-like (fig. 44*b*), without inner marginal bristle; right fifth foot of male with forceps.

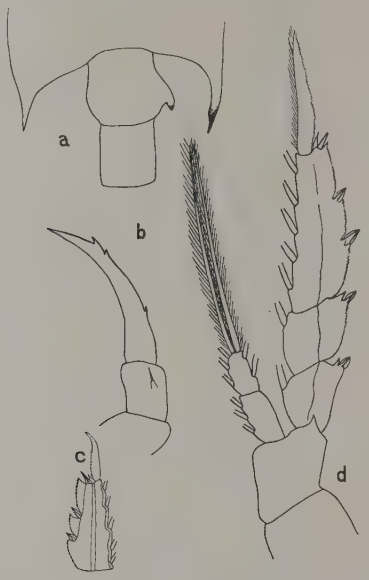

Fig. 44.—*Candacia pectinata.* (*a*) Last thoracic segment and first and second segments of abdomen, male, ×45. (*b*) Fifth foot of female ×83. (*c*) Third joint of outer ramus of third foot of male ×49. (*d*) Fourth foot of female ×83.

Coloration: Rather transparent, lateral prolongations of last thoracic segments, genital orifice, rami and bristles of feet and mouth parts, joints 18 and 19 of grasping antenna, usually a blackish brown.

Length: Females average 2 mm., males 1.9 mm.

Occurrence: Rather common; both sexes are taken in summer and winter.

2. **Candacia bipinnata** Giesbrecht.

Candace bipinnata Giesbrecht, 1889, p. 5; 1892, pp. 424, 439; pl. 22, fig. 20; pl. 39, figs. 27, 29.
Candacia bipinnata Giesbrecht, 1898, p. 129.

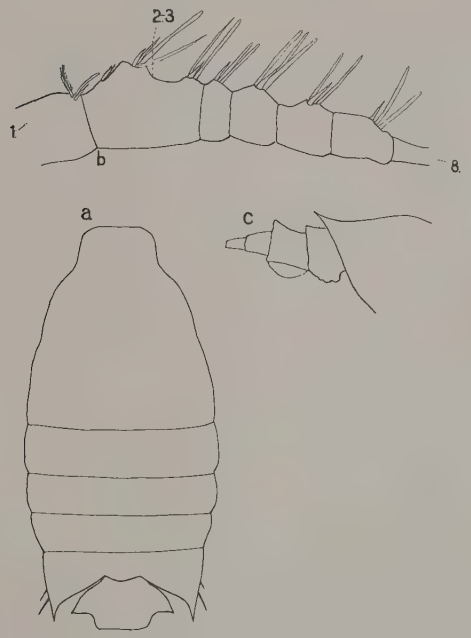

Fig. 45.—*Candacia bipinnata.* (*a*) Cephalothorax and genital segment of female, dorsal, ×31. (*b*) First eight joints of anterior antennae of female ×83. (*c*) Last thoracic segment and abdomen of female ×20.

♀ Like *C. pectinata,* but genital segment (fig. 45*a*) is broad and has a wing-like expansion on each side. ♂ Unknown.

Coloration: Much as in *C. pectinata.*

Length: Female, 2.6 mm.

Occurrence: Taken usually with *C. pectinata,* but in fewer numbers.

3. **Candacia curta** Dana.

Candace curta Dana, 1849, p. 279; 1852, p. 1116; 1855, pl. 78, figs. 6 *a-d.*
Candace curta Giesbrecht, 1892, pp. 424, 439, pl. 21, fig. 15; pl. 22, figs. 12, 24; pl. 39, figs. 8-10, 12.
Candacia curta Giesbrecht, 1898, p. 129.

Fig. 46.—*Candacia curta.* Male. (*a*) Last thoracic segment, and genital segment, lateral, ×83. (*b*) Same, dorsal, ×31. (*c*) Fifth foot ×83. Right foot at right of figure.

Allied to *C. pectinata,* but right side of genital segment in female has a ventral projection; fifth foot of female with two heavy teeth on the end, and one on the inner border. Proximal joint of inner ramus of first foot with but two inner marginal bristles.

Coloration: As in preceding species, with very slight variations.

Length: Male, 1.5 mm. Giesbrecht gives 2.4-2.65 mm.

Occurrence: San Diego, Jan. 4, 1904, one male.

4. **Candacia aethiopica** Dana.

Candace ethiopica Dana, 1848, p. 23.
Candace melanopus Claus, 1863, p. 191, pl. 33.
Candace ethiopica Giesbrecht, 1892, pp. 424, 439, pl. 4, fig. 13, pl. 21, figs. 1, 9; pl. 22, figs. 1, 6, 13, 14, 32, 40-42; pl. 39, figs. 7, 11, 13.
Candacia aethiopica Giesbrecht, 1898, p. 128.

Genital segment of female slightly asymmetrical, with a process on the left side; last thoracic segment of male asymmetrical. Anterior antennae 23-jointed, denticulation of the geniculating joints of grasping antenna fine, joints proximal and distal to the geniculation long and slender. Proximal hooked bristle of the second basal of the anterior maxilliped as thick and almost as long as the distal (fig. 47*h*). Terminal joint of fifth foot of female with one tooth on the outer margin, 3 apical teeth, and 3 bristles on the inner border; right fifth foot of male with a forceps (fig. 47*g*).

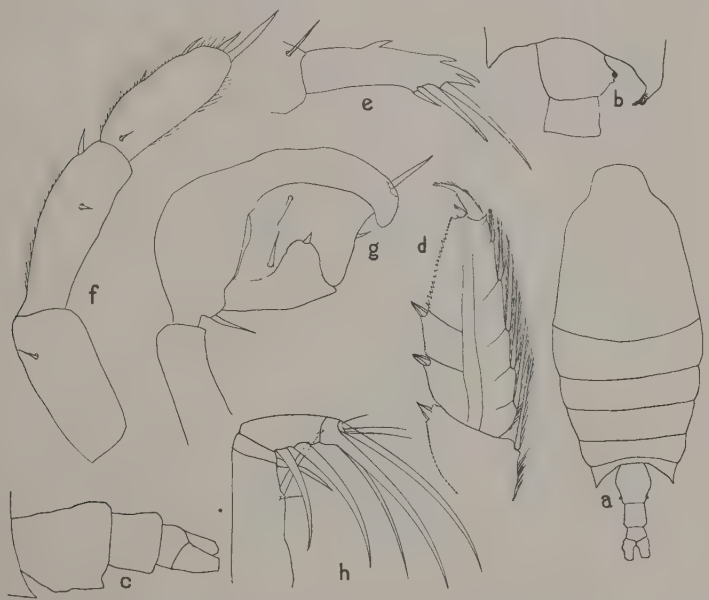

Fig. 47.—*Candacia aethiopica.* (*a*) Female, dorsal, ×165. (*b*) Last thoracic segment, and genital segment of male, dorsal, ×60. (*c*) Abdomen of female, lateral, ×37. (*d*) Second and third joints of outer ramus of third foot, female, ×60. (*e*) Fifth foot of female ×130. (*f*) Left fifth foot of male ×130. (*g*) Forceps of right fifth foot of male ×130. (*h*) Anterior maxilliped of female ×130.

Coloration: Dorsal surface of cephalothorax, excepting anterior portion of head and the last thoracic segment, black brown,

distinguishing the species at once. Appendages colored about as in the other forms.

Length: Female 2.9 mm, male 2-2.5 mm.

Occurrence: Several males and females were taken October 20, 1904.

Fam. PONTELLIDAE.

Pontellidae Giesbrecht, 1892, p. 68; 1898, p. 131.

♀ Head and thorax distinct, fourth thoracic segment usually fused with fifth. Rostrum forked, usually ending in two very strong prongs; rarely absent. Eyes large, sometimes with one or two pairs of cuticular lenses and one unpaired lens. Anterior antennae 16- to 24-jointed, the two terminal joints always fused. Second basal and first joint of inner ramus fused, terminal joints of outer ramus shortened. Mandible on the whole as in the *Centropagidae.* First basal of maxilla large, second basal and rami relatively small. Anterior maxillipeds as in the *Centropagidae,* long, hooked bristles on distal portion and commonly on the proximal. First basal of posterior maxillipeds large with long bristles on lobed inner border, second basal and inner ramus relatively small. Inner ramus of four anterior pairs of feet or second to fourth, 2-jointed; fifth pair rudimentary, outer ramus 1-jointed (rarely 2-jointed), inner ramus 1-jointed or lacking.

♂ Distinct from female in form of abdomen, anterior antennae and fifth pair of feet, at times also in form of eyes, rostrum and last thoracic segment. Genital orifice on left side, grasping antenna on right, middle joints much or slightly broadened; joints 19 and 21 and 22 to 25 fused. Fifth pair of feet rarely with rudiment of inner ramus; forceps of right foot incomplete or very powerful.

Sub-fam. Pontellinae.

Pontellina Giesbrecht, 1892, p. 68.

♀ Cephalothorax with five or six segments; last thoracic segment ends in one (seldom two) sharp points on each side and is at times asymmetrical. Rostrum ends in two strong chitinous prongs or in two filaments. One pair of cuticular lenses is occasionally found on the dorsal side, seldom two pairs, ventral

eye strongly protruding (fig. 48*c*). Abdomen with from one to three segments, never symmetrical. Anterior antennae 16- to 24-jointed, at least two terminal joints fused, usually also a number of proximal joints. Posterior antennae with reduced number of terminal joints in outer ramus which is often more slender and thinner than the inner ramus. Mandible as a whole as in *Centropages,* blade with at least five teeth. Maxilla with relatively large proximal basal, second inner marginal lobe large, second basal, rami and first outer marginal lobe accordingly relatively smaller. Anterior maxilliped as in *Centropages,* with very strong hooked bristles; posterior maxilliped short, first basal with indented or folded inner margin, set with long, strong bristles; inner ramus 3- to 5-jointed, bristles short. Outer ramus of four anterior feet 3-jointed, inner ramus of second to fourth pairs or of all 2-jointed. Basal of fifth pair 2-jointed, inner and outer rami usually 1-jointed; outer ramus seldom 2-jointed.

♂ Sexual peculiarities in form of body, more often in eyes, anterior antennae and fifth foot. Last thoracic segment as a rule asymmetrical, right posterior angle more strongly developed; abdomen with 5 segments, in cases with asymmetrical processes on right side. Right anterior antenna with broadened middle joints; beyond the geniculation either the nineteenth and twenty-first joints only are fused (besides the twenty-fourth and twenty-fifth) or also the twenty-second and twenty-third; fifth foot without inner ramus (perhaps a rudiment on left foot), four jointed on each side, the right foot with forceps.

1. Genus **Labidocera** Lubbock.

Pontella (part) Dana, 1846, p. 184; 1848, p. 26; 1849, p. 280.
Pontellina (in part) Dana, 1852, p. 1135.
Labidocera (sub-genus) Lubbock, 1853*a*, p. 25; 1853*b*, p. 202.
Pontella Claus, 1863, p. 207; 1893, p. 233.
Pontella Brady, 1878, p. 73; 1883, p. 87.
Pontella Thompson, 1887, p. 34.
Labidocera Giesbrecht, 1889, p. 7; 1892, pp. 70, 444, 746; 1897, p. 254; 1898, p. 132.
Labidocera T. Scott, 1893, p. 82.
Labidocera Wheeler, 1899, p. 178.

Head usually without hooks on side; one pair of dorsal eye lenses, larger in the male than in the female; rostral hooks strongly chitinized. Cephalothorax of 5 segments, ending in points laterally, more strongly developed on right side in the male Abdomen of female with 2 or 3 segments, of male with 5, sometimes asymmetrical in the female. Anterior antennae of female 23-jointed; terminal section of grasping antenna (the right) of male 4-jointed. Mandibular blade with 5-7 hooked, pointed teeth. Second basal of maxilla bent toward outside, about twice as long as the second lobe of the inner margin; anterior maxilliped stunted and provided with strong hooked bristles especially on the distal half; posterior maxilliped with 4-jointed inner ramus. Inner ramus of swimming feet 2-jointed, outer ramus 3-jointed; fifth foot of female on each side with 2-jointed basal portion, rami 1-jointed, though the inner ramus may be rudimentary. Fifth foot of male 4-jointed on each side, right without inner ramus, left at times with rudi mentary inner ramus. The two terminal joints of the right foot form a powerful forceps.

1. **Labidocera trispinosa** n.sp.

♀ Cephalothorax symmetrical, evenly rounded in front; crest, and hooks on side of head absent; rostrum bifid, very long; last thoracic segment produced on each side into sharp points (*cf.* fig. 48*a*, left side). Abdomen with 3 segments, genital longer than the last two, asymmetrical, with a prominent blunt wing-like process on the right side (fig. 48*d*); middle abdominal segment with a knob-like projection on the left in front. Furca symmetrical, about 3 times as long as broad. Anterior antennae extending back to the posterior border of fourth thoracic segment. Fifth pair of feet symmetrical (fig. 48*g*), outer ramus ending in two teeth, the inner one twice as long as the outer; inner ramus about one-half as long as the outer, articulating with basal; outer ramus longer than the first and second basals together.

♂ Eye lenses larger, and more nearly contiguous (fig. 48*a*). Last thoracic segment on right side with a long slender spine,

curving dorsally, (fig. 48*b*), a shorter straight dorsal spine, and a very short spine directed toward median line. On the left side the thorax is about as in the female. Abdomen with five segments, genital segment in some cases slightly asymmetrical; orifice on right side; middle segment as long as the first two, and longer than the last two. Anterior antennae reaching to base of furca; joints 16 and 17 about of equal length; teeth on joint 18 directed toward distal end of antenna, those on the next joint larger and straight (fig. 48*h*). Fifth foot, fig. 48*e, f*.

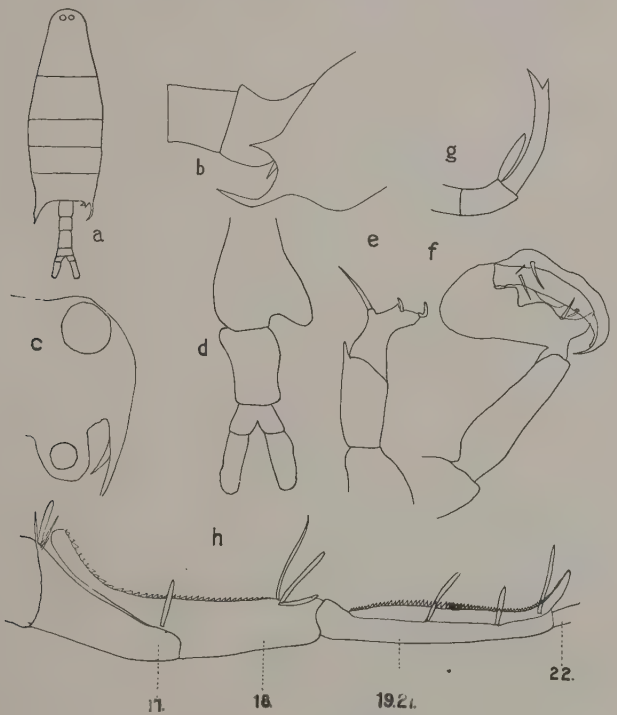

Fig. 48.—*Labidocera trispinosa, n. sp.* (*a*) Male, dorsal, ×18. (*b*) Lateral portion of last thoracic segment from right side ×60. (*c*) Head of male, lateral, ×60. (*d*) Abdomen of female, dorsal, ×60. (*e*) Left fifth foot of male. (*f*) Right fifth foot of male. (*g*) Fifth foot of female. (*h*) Joints 17, 18, 19 to 21, 22, of grasping antenna of male, ×160.

This species is distinct from any of the seventeen described species of *Labidocera* in the form of the last thoracic segment of the male, and the genital segment of the female. It approaches *L. lubbocki* Giesbrecht and *L. brunescens* Giesbrecht, more closely than any others, but differs distinctly from them in the above-named features as well as in the structure of the fifth feet of the sexes, etc.

Coloration: Rather transparent, intestinal contents light green, thorax and abdomen yellowish with green tinge in places.

Length: Female, 1.6 mm. Male, 1.7-2.2 mm.

Occurrence: May 24, 1904, one female. June 16, 1904, four males, five females.

Sub-fam. Parapontellinae.

Parapontellina Giesbrecht, 1892, p. 73.

Cephalothorax usually with five, seldom with six segments, rostral filaments slender or lacking, last thoracic segment with rounded or pointed sides. Eyes without dorsal chitin lenses.

♀ Abdomen usually with three, seldom two segments, at times asymmetrical. Anterior antennae 17- to 19-jointed; several proximal joints fused in addition to the terminal points. Second basal of mandible elongate, usually cylindrical, blade narrow with from five to seven teeth. Maxilla elongate, lobes slightly protruding and not articulating; rami more often stunted; the entire second basal may be absent. Distal hooked bristles of anterior maxillipeds long and strong, seldom so on proximal portion of the appendage. Posterior maxilliped as in the *Pontellinae* but inner ramus is only 1- or 2-jointed. Outer ramus of anterior four pairs of feet 3-jointed, inner ramus of second to fourth or of all 2-jointed. Fifth pair stunted, basal 1- or 2-jointed, outer ramus 1-jointed usually claw-like and without inner ramus; not always symmetrical.

♂ Sexual peculiarities in form of body, anterior antennae and fifth foot. Last thoracic segment and abdomen at times asymmetrical as in many *Pontellinae;* abdomen with five segments. The right grasping antenna simulated in some respects in the left; the right antenna with but little broadened middle joints and differences in the segmentation of the joints in the

proximal portion; joints nineteen and twenty-one and twenty-two and twenty-five fused. Right fifth foot 3- to 4-jointed, forceps not complete, the left 3-jointed, seldom with rudiment of inner ramus.

1. Genus **Acartia** Dana.

Acartia Dana, 1846, p. 183; 1852, p. 118.
Dias Brady, 1883, p. 72.
Dias Lilljeborg, 1853.
Dias Claus, 1863, p. 191.
Dias Brady, 1883, p. 72.
Acartia Thompson, 1888*a*, p. 149; 1888*b*, p. 141.
Acartia Giesbrecht, 1892, pp. 75, 506, 721; 1898, p. 150.
Acartia Dahl, 1894*c*, p. 13.
Acartia Wheeler, 1899, p. 182.

Fifth thoracic segment and abdomen of male symmetrical; latter with shortened anal segment. Antennae of female with seventeen segments, of the same diameter throughout the length; grasping antenna of male with very slightly thickened middle joints. Outer ramus of posterior antenna much shorter than the inner; second joint of inner elongated, first joint with nine bristles on the inner border. Outer ramus of mandible articulates in the middle of the margin of the second basal. First outer marginal lobe of maxilla with long bristles, outer ramus rudimentary, its place supplied by two bristles. Proximal lobes of anterior maxillipeds well developed, with long bristles; posterior maxilliped with four joints. Inner ramus of first pair of feet with two joints, fifth pair of female without inner ramus, with long outer terminal bristle on second basal.

♀ Cephalothorax with five segments, last two fused. Posterior antenna very slender, second basal joint fused with proximal joint of inner ramus, mandible with weak blade, which has seven teeth. Posterior maxilliped without outer marginal bristles, and with three inner marginals on third joint. Outer ramus of first to fourth pairs of feet 3-jointed, first basal without bristles, second with rather long outer marginal bristle in fourth pair. The very much stunted fifth pair (fig. 49*d*) consists on each side of two or three joints; the end joint (outer ramus) is a thick stylet-shaped bristle, and on the outer border of the second basal is a slender feathered bristle.

♂ Sexual differences in form of body, anterior antennae and fifth pair of feet. Abdomen with five segments, genital orifice on left side; the fourth segment and furca shortened. The right anterior antenna is a grasping organ and joints 19-21 and 22-25 are fused. The fifth pair of feet (fig. 49*c*) consists of a common middle part and a right foot of four joints, a left of three, each uniramous. The right especially has the form of a claw, which, because of a process on the joint preceding the terminal, becomes an incomplete forceps.

1. **Acartia tonsa** Dana.

Acartia tonsa Dana, 1848, p. 26.
Acartia tonsa Giesbrecht, 1892, pp. 508, 522; pl. 30, figs. 7, 24, 34; pl. 43, figs. 6, 10; 1898, p. 154.

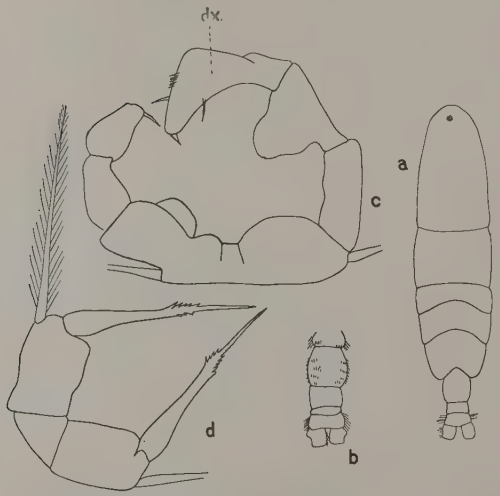

Fig. 49.—*Acartia tonsa.* (*a*) Female, dorsal, ×45. (*b*) Abdomen of male, dorsal, ×55. (*c*) Fifth foot of male ×138. *Dx.*, right foot. (*d*) Fifth foot of female ×138.

Rostral filaments present, last thoracic segment rounded laterally; abdomen of male (fig. 49*b*) with spines on the second segment; anal segment with lateral hairs. Anterior antennae of female without thorns, not reaching to the posterior border of

the genital segment. Middle joint of fifth foot of female about as broad as long (fig. 49*d*); terminal portion of foot as long as the rest of the appendage, straight, toothed posterior to middle; plumose bristle as long as terminal claw. Second joint of right fifth foot of male (fig. 49*c*) without process on inner margin; process of third and fourth joints broader than in *A. clausi*.

Coloration: Very transparent, without pigment.

Length: Female, 1.2-1.5 mm. Male, 1-1.1 mm.

Occurrence: Enormous quantities may be obtained in Glorietta Bight, San Diego Bay, especially at night; the species occurs rather infrequently outside.

II Sub-order.—PODOPLEA.

Body divided into an anterior and posterior portion but the line of separation falls in front of the last thoracic segment (fig. 50*a*); the posterior portion of the body has as the first segment the fifth thoracic segment, which bears almost without exception a rudimentary pair of feet (figs. 50*a*, 57*b*); these are never of service to the male in pairing. The spermatophores are placed directly upon the genital orifice of the female, without the use of a pair of appendages. The genital organs of the male are usually paired, their orifices always symmetrically placed. The female carries the eggs until the young are set free.

KEY TO THE GENERA OF THE PODOPLEA.

(The genera marked with an asterisk have been found in the San Diego region.)

1. Inner rami of third and fourth feet 3-jointed, or lacking in fourth pair 2
1. Inner rami of third and fourth feet 1-jointed..... **Mormonilla**
2. Inner ramus of first foot 1-jointed 3
2. Inner ramus of first foot 2-jointed (fig. 53*c*)..... 14
3. Head with two large chitinous lenses (figs. 62, 57*b*)..... 4
3. Head without chitinous lenses 7
4. Inner ramus of fourth foot 2- or 3-jointed (fig. 59*b*)..... 5
4. Inner ramus of fourth foot 1-jointed or replaced by bristles (fig. 63*b*) 6
5. Abdomen with four or five segments which are broadened laterally (figs. 57*a*, 59*a*)..... ***Sapphirina**

5. Abdomen with two segments, not broadened.....**Corina**
6. Eye lenses separated by at least their diameter; the last two thoracic segments without lateral sharp prolongations.....**Copilia**♀
6. Eye lenses placed close together, last two segments of the anterior portion of the body prolonged into lateral pointed processes (figs. 61*a*, 62*b*).....***Corycaeus**
7. Entire body much flattened, furca very long and stylet-like..**Copilia**♂
7. Body of various shapes but more rounded; if at times depressed, never leaf-like 8
8. Outer ramus of first foot 1-jointed, postero-lateral angles of fourth segment of body prolonged into processes (fig. 54*a*).... ..... ***Clytemnestra**
8. Outer ramus of first foot 2- to 3-jointed..... 9
9. Outer ramus of posterior antenna 1-jointed; furca very short, each ramus with a very long bristle twice as long as the body at least; rami of furca and the two bristles fused in the median line; remaining furcal bristles stunted.....**Aegisthus**
9. Outer ramus of posterior antenna 3-jointed; furca short, rami separate (fig. 52*c*), each with a long bristle, at least as long as the body, and at least twice as long as the other bristles (fig. 52*a*)..... ***Microsetella**
9. Outer ramus of posterior antenna lacking; furca longer than broad, rami separate 10
10. Anterior and posterior maxillipeds alike in structure, both with long, spinous bristles .....***Oithona**
10. Posterior maxilliped with few or no short bristles and a terminal hook (Oncaeidae) (figs. 55*b*, 56*b*) 11
11. Fifth pair of feet 1-jointed, with two lancet-shaped appendages at the end which have dentate borders; body elongate..**Lubbockia**
11. Fifth pair 1- or 2-jointed or knob-like, with naked or plumose bristles; body more robust 12
12. Anterior antennae with very long and thick aesthetasks on the terminal joints; fifth feet 2-jointed .....**Ratania**
12. Anterior antennae with numerous pencillate aesthetasks on the proximal joints; fifth foot a protuberance.....**Pachysoma**
12. Anterior antennae with few and very delicate aesthetasks; fifth foot reduced to a small rod or knob, or at times to one bristle 13
13. Terminal hooked bristles on the posterior antenna of medium length; inner ramus of rear feet at least as long as the outer, terminal joint in fourth pair at least 1½ times as long as the first and second joints together .....***Oncaea**
13. Hooked bristles on the much elongated terminal joint of posterior antennae very long; inner ramus of rear feet shorter than outer, its terminal joint in the fourth pair no longer than each of the proximal joints .....**Conaea**
14. Front of head with two great chitinous lenses.....**Miracia**
14. Head without lenses 15
15. Forehead conical, rounded in front; body very narrow; outer ramus of posterior antennae lacking ..... **Setella**

15. Forehead pointed (fig. 53*a*); body broad; outer ramus of posterior antenna 1-jointed..... 17
16. Furca with separate rami (about twice as long as broad) and bristles much shorter than body (fig. 53*a*).....*Euterpe
16. Rami of the fuca very short and with the two unusually long bristles fused in the median line.....Aegisthus

Fam. CYCLOPIDAE.

1. Genus **Oithona** Baird.

Oithona Baird, 1843.
Scribella Dana, 1847, p. 279; 1848, p. 19.
Oithona Dana, 1852, p. 1097.
Oithona Claus, 1863, p. 104.
Oithona Brady, 1883, p. 97.
Oithona Giesbrecht, 1892, pp. 77, 537, 753; 1896, p. 324.
Oithona Wheeler, 1899, p. 186.

♀ Anterior and posterior parts of body composed of five segments, first and second abdominal segments fused (fig. 50*a*). Genital opening lateral. Anterior antennae rather obscurely jointed, bristles long; posterior antennae 3-jointed, outer ramus absent. Inner ramus of mandible small, 1-jointed, outer ramus 4-jointed; blade dentate. Rami of maxilla 1-jointed, inner ramus small. Maxillipeds slender, bristles strong, spinous; inner ramus of posterior maxilliped 2-jointed. Rami of swimming feet 3-jointed. Fifth pair very rudimentary, being reduced to two bristles on each side.

♂ Front of head blunt (fig. 51*a*); first and second abdominal segments not fused (fig. 50*b*, 51*a*), bristles of furca short. Anterior antenna are grasping organs, geniculating at two places. Swimming feet somewhat irregular in number and arrangement of bristles.

1. **Oithona plumifera** Baird.

Oithona plumifera Baird, 1843.
Oithona plumifera Dana, 1852, p. 1099, pl. 76, figs. 4*a-e*.
Scribella scriba Dana, 1849, p. 279.
Oithona spinirostris Claus, 1863, p. 105.
Oithona plumifera Giesbrecht, 1891, p. 475; 1892, pp. 537, 548; pl. 4, fig. 10; pl. 34, figs. 12, 13, 22, 25, 27-29, 32, 33, 44-47; pl. 44, figs. 1, 7, 12-15.
Oithona plumifera Wheeler, 1899, p. 186, fig. 22.

♀ Front ending in a somewhat ventrally directed, pointed beak, but visible in dorsal view. Furca shorter than anal seg-

ment, about three times as long as broad, outer marginal bristle about three times as long as the furca. Anterior antennae extend to the posterior border of the fourth abdominal segment. Second basal of mandible with two hooked bristles; inner ramus of maxilla with a minute bristle. Outer ramus of first pair of feet (fig. 50*d*) with one outer marginal bristle on the first joint, one on the second and two on the third; outer ramus of the second and third pairs, with one on the first joint, none on the second and two on the third; of the fourth pair with none

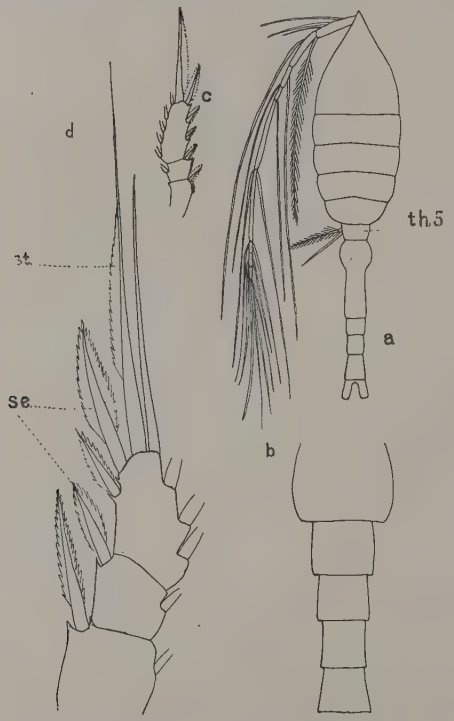

Fig. 50.—*Oithona plumifera.* (*a*) Female, dorsal, ×40. *Th.*5, fifth thoracic segment. (*b*) Abdomen of male ×140. (*c*) Outer ramus of third foot of male ×83. (*d*) Outer ramus of first foot of female ×265. *Se.*, outer marginal bristles. *St.*, terminal bristle.

on the first and second joints, two on the third; proximal bristle of outer margin of third joint of third and fourth pairs reduced.

♂ Genital segment broad (fig. 50*b*). Proximal joint of distal portion of anterior antennae with a half crescentic process on the inner margin. Third joint of outer ramus of first and fourth pairs of feet with two outer marginal bristles, the second and third with three (fig. 50*c*).

Coloration: Giesbrecht shows red pigment in body, and especially in long bristles of anterior antennae, furca, feet and mouth parts, while other animals may be colorless. All specimens I have seen are colorless.

Length: Female, 1-1.4 mm.; male, 0.75-1 mm.

Occurrence: Not as abundant as *O. nana,* but some specimens occur in all catches where the ordinary Podoplea are numerous, summer and winter.

2. **Oithona nana** Giesbrecht.

Oithona nana Giesbrecht, 1892, p. 549, pl. 4, fig. 8; pl. 34, figs. 10, 11, 20, 24, 26, 34, 35, 42; pl. 44, figs. 2, 4.

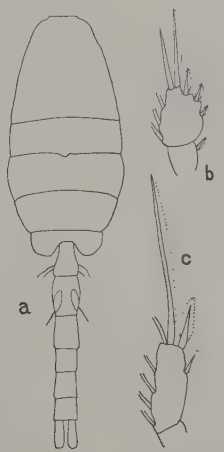

Fig. 51.—*Oithona nana.* (*a*) Male, dorsal, ×83. (*b*) Third joint of outer ramus of first foot of female ×83. (*c*) Third joint of outer ramus of fourth foot of male ×83.

♀ Front blunt; furca as long as the anal segment, hardly twice as long as broad, outer marginal bristle about as long as the furca. Anterior antennae reach about to the posterior margin of the third thoracic segment. Second basal of mandible with one hooked bristle. Inner ramus of maxilla with four bristles. First, second and third (fig. 51*b*), joints of outer ramus of first to third feet respectively, with one, one, three outer marginal bristles, of the fourth with one, one, two.

♂ Division line between the first and second thoracic segments with a sharp median projection; genital segment narrower than in *O. plumifera.* Proximal joint of the distal portion of the anterior antennae without the round process. Third joint of outer ramus of first to third feet with three outer marginal bristles, of the fourth with two (fig. 51*c*).

Coloration: Transparent, without pigment.

Length: Female, 0.7-0.8 mm.; male, 0.5-0.6.

Occurrence: Rather abundant in hauls taken from inside of the kelp beds at Point Loma. Both sexes found. The tow in which Oithona occurs most plentifully contains scarcely any other genera than *Oncaea, Euterpe* and *Corycaeus.*

Fam. HARPACTICIDAE.

1. Genus **Microsetella** Brady and Robertson.

Microsetella Brady and Robertson, 1873, p. 130, pl. 9, figs. 11-16,
Harpacticus Dana, 1847, p. 152.
Canthocamptus Dana, 1852, p. 1187.
Ectinosoma Brady, 1883, p. 99.
Ectinosoma Möbius, 1887, p. 116.
Microsetella Giesbrecht, 1892, pp. 78, 549, 750.

♀ Body cylindrical, smaller in front and behind, anterior portion with four segments, posterior with five; furca short, bristles very long. Anterior antennae 5-jointed, posterior 3-jointed, outer ramus 3-jointed and slender. Rami of first to fourth feet 3-jointed, inner ramus longer than outer; fifth pair rudimentary and leaf-like (fig. 51*b*).

♂ Posterior portion of body with five segments, anterior antennae rather strong grasping organs; feet much smaller.

1. **Microsetella rosea** Dana.

Harpacticus roseus Dana, 1847, p. 153.
Canthocamptus roseus Dana, 1852, p. 1189; 1855, pl. 83, figs. 1-10.
Microsetella rosea Giesbrecht, 1892, pp. 550, 554, pl. 44, figs. 32, 35, 37, 38, 41, 43, 48, 49.

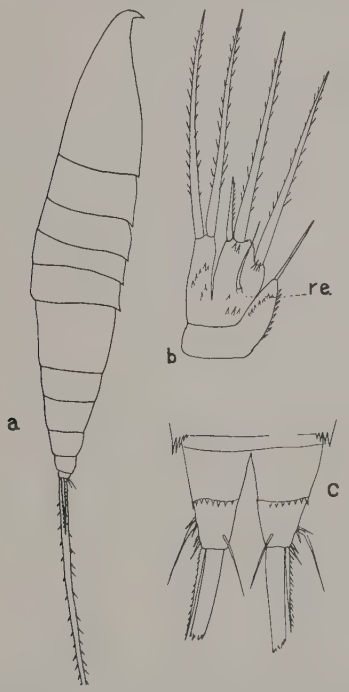

Fig. 52.—*Microsetella rosea.* Female. (*a*) Lateral ×83. (*b*) Fifth foot ×195. *Re.*, outer ramus. (*c*) Furca, ventral, ×195.

♀ Longest bristle of furca almost twice as long as the body, third terminal bristle less than half as long as the abdomen. Innermost bristle of fifth foot not much shorter than the others.

♂ Unknown.

Coloration: Rather transparent, region of mouth red, and also long furcal bristles; digestive tract rosy red.

Length: Female, 0.84—0.9 mm.

Occurrence: June 10, 1904, five females; catch taken near La Jolla.

2. Genus **Euterpe** Claus.

Harpacticus Dana, 1847, p. 152; 1852, p. 1189.
Euterpe Claus, 1863, p. 109.
Euterpe Giesbrecht, 1892, pp. 78, 555.

♀ Anterior portion of body with four segments, posterior with five; front of head pointed (*cf.* fig. 53*a*). Anterior antennae 7-jointed, posterior 3-jointed, outer ramus 1-jointed. Rami of swimming feet 2-jointed in the first pair, 3-jointed in second to fourth pairs; fifth pair rudimentary (fig. 53*d*).

♂ First and second abdominal segments not fused (fig. 53*a*); anterior antennae (fig. 53*e*) are powerful grasping organs, fourth and fifth joints fused and much thickened, geniculating with the hooked terminal joint which is composed of the fused sixth and seventh joints. Rami, especially the inner, of the first pair of feet of peculiar form; fifth pair shorter and with fewer bristles than in the female.

1. **Euterpe acutifrons** Dana.

Harpacticus acutifrons Dana, 1847, p. 153; 1852, p. 1192; 1855, pl. 83, fig. 11*a*, *b*.
Euterpe gracilis Claus, 1863, p. 109, pl. 14, figs. 1-13.
Euterpe acutifrons Giesbrecht, 1892, p. 555, pl. 44, figs. 16-31.

The only species of the genus.

Coloration: Transparent, almost without pigment, but digestive canal is often yellowish or green.

Length: Male, .73 mm.; females slightly smaller.

Occurrence: Abundant in catches with *Oithona*, *Oncaea* and *Corycaeus*.

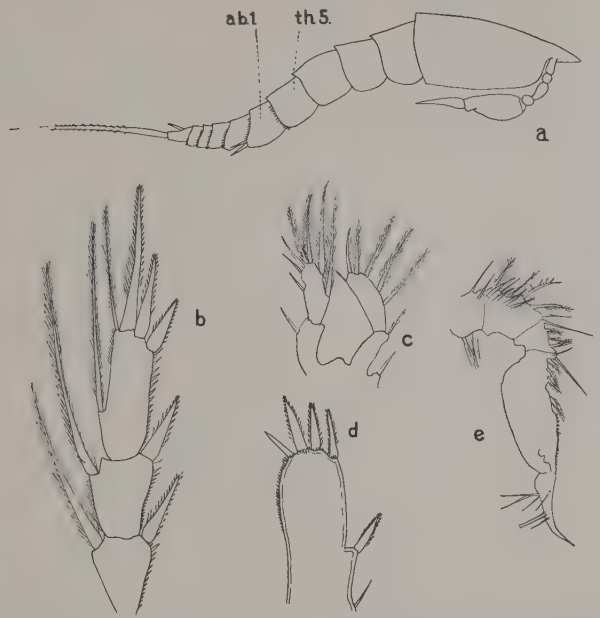

Fig. 53.—*Euterpe acutifrons.* (*a*) Male, lateral, ×175. *Ab.*1, first abdominal segment. *Th.*5, fifth thoracic segment. (*b*) Outer ramus of fourth foot of female ×140. (*c*) First foot of male ×265. (*d*) Fifth foot of female ×410. (*e*) Anterior antenna of male ×195.

3. Genus **Clytemnestra** Dana.

Clytemnestra Dana, 1847, p. 154; 1852, p. 1193.
Clytemnestra Lubbock, 1860, p. 180.
Goniopsyllus Brady, 1883, p. 107.
Clytemnestra Giesbrecht, 1892, pp. 79, 565, 733.
Clytemnestra Wheeler, 1899, p. 188.

♀ Anterior part of body composed of four segments, posterior part of five; furca short. Anterior antennae 7- to 8-jointed, bristles short, posterior antennae 3-jointed, outer ramus supplied by one or two bristles. Posterior maxilliped 2-jointed, slender and elongated, with short hooks at the end. Rami of swimming feet long and narrow, inner ramus the longer, 3-jointed in all pairs; outer ramus 3-jointed except in first pair, where it is 1-jointed; fifth pair rudimentary, 2-jointed.

♂ Posterior portion of body with six segments, furcal bristles sometimes lengthened. The anterior antennae are grasping organs, geniculating between the last two joints; posterior maxillipeds longer, with thicker second joint and longer terminal hook.

1. **Clytemnestra rostrata** Brady.

Clytemnestra tenuis Lubbock, 1860, p. 160, pl. 29, figs. 6-7.
Goniopsyllus rostratus Brady, 1883, p. 107, pl. 42, figs. 9-16.
Clytemnestra rostrata Giesbrecht, 1892, pp. 566, 572, pl. 45, figs. 19, 20, 22, 25, 26, 31, 33.
Clytemnestra rostrata Wheeler, 1899, p. 189, fig. 26.

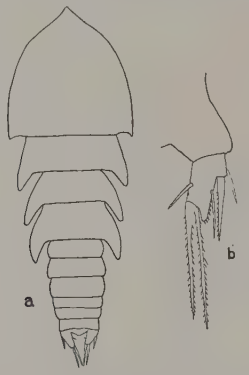

Fig. 54.—*Clytemnestra rostrata.* Female. (*a*) Dorsal, ×45. (*b*) Furca, dorsal, ×265.

Furca at most as long as broad, bristles not plumose, equal in length in both sexes. Anterior antennae in each sex seven-jointed, last joint in female five times as long as the preceding one; lancet-shaped bristle lacking in the male. Outer ramus of posterior antenna replaced by one bristle; second basal of first foot without bristle on outer margin, outer ramus with three bristles; outer ramus of second foot with one outer marginal bristle on first and second joints, two on the third; second joint of inner ramus of third foot longer than the terminal joint. Fifth foot as long as the outer ramus of the fourth, with five bristles on the terminal joint, which are as long in the female as in the male.

Coloration: Reddish, due to the presence of rose, brown or greenish oil globules in the transparent body.

Length: Female, 1.28 mm.

Occurrence: Rather uncommon; one female was taken June 14, 1904, at San Diego. Occurs also in the winter.

Fam. ONCAEIDAE.

Oncaeidae Giesbrecht, 1892, p. 81.

Paired eyes with cuticular lenses and pigment bodies not developed.

♀ Form of body in general like the *Cyclopidae*. Each portion of the furca has six bristles. Anterior antennae 4- to 6-jointed; posterior antennae 3- or 4-jointed; mandibles reduced to blade, without specific form. Maxillae are bristle-bearing platelets, usually separated into two lobes. Anterior maxilliped 2-jointed. Posterior maxilliped 4-, seldom 3-jointed, terminal hook strong. First to fourth pairs of feet with 3-jointed rami; inner ramus of fourth foot longer or but little shorter than the outer.

♂ Sexual peculiarities in form of abdomen and posterior maxillipeds, fewer joints usually in anterior antennae, rarely in posterior antennae and mouth parts.

1. Genus **Oncaea** Philippi.

Oncaea Philippi, 1843, p. 62.
Antaria Dana, 1852, p. 1227.
Antaria Claus, 1863, p. 158.
Antaria Brady, 1883, p. 119.
Oncaea Lubbock, 1860, p. 183.
Oncaea Giesbrecht, 1892, pp. 81, 590, 755.

Shape of body as in *Oithona*. Terminal joints of inner rami of swimming feet long and narrow, that of the fourth pair at least one and one-half times as long as the first and second together; fifth foot rod or knob-shaped.

♀ Both portions of body with five segments (figs. 55*a*, 56*a*). Anterior antennae 6-jointed, posterior 3-jointed, hooked bristles of medium length (*cf.* fig. 56*c*). Posterior maxillipeds 4-jointed, rows of spines on inner border of second basal. Outer marginal bristles of outer rami of first and second feet as follows:

One on the first and second, three on the third joint; of the third and fourth feet, one on the first and second, two on the third joint.

♂ Abdomen with five segments, genital segment large, lips of the orifice with spines at the sides. Posterior maxilliped with more muscular second basal, and more strongly curved terminal hook than in the female. In the anterior antennae the three short terminal joints are fused into one piece.

1. **Oncaea conifera** Giesbrecht.

Antaria mediterranea Claus, 1863, p. 159, pl. 30, figs. 1-7.
Oncaea conifera Giesbrecht, 1892, pp. 591, 603, pl. 2, fig. 10; pl. 47, figs. 4, 16, 21, 28, 34, 38, 42, 55, 56.

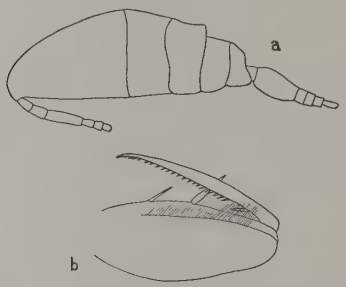

Fig. 55.—*Oncaea conifera.* Female. (*a*) Lateral ×45. (*b*) Posterior maxilliped ×265.

♀ Median portion of second thoracic segment protruding from the dorsal surface of the body (fig. 55*a*), genital segment almost one and one-half times as long as the rest of the abdomen, the following segments broader than long. Furca as long as the fifth abdominal segment, between two and two and one-half times as long as broad, its branches strongly directed away from each other. Hook at end of posterior maxilliped set with thick spines, distal bristles of second basal heavier and longer than the proximal (fig. 55*b*). Processes at end of third joint of inner ramus of swimming feet very large, present even in the fourth pair, the adjacent lancet-like bristle shortened. Fifth pair of feet elongated, with thickened terminal bristle.

♂ Lips of genital orifice long, furca short and broad.

Coloration: Often distinctly green-yellow tint to body, which is not very transparent.

Length: Female, 1.2 mm.; male, about 0.8 mm.

Occurrence: A few were taken June 14, 1904, and in some cases the sexes were pairing.

2. **Oncaea minuta** Giesbrecht.

Oncaea minuta Giesbrecht, 1892, p. 603, pl. 47, figs. 3, 6, 26, 46, 59.
Oncaea minuta (male) Aurivillius, 1899, p. 29, figs. 1-3.

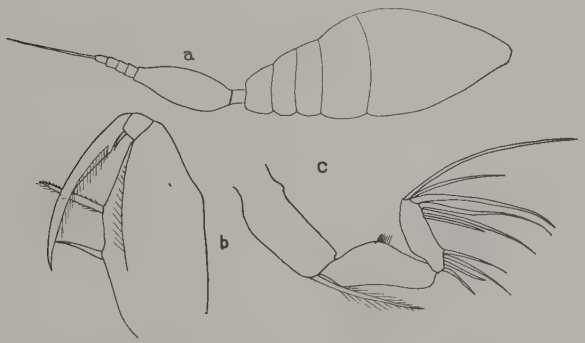

Fig. 56.—*Oncaea minuta.* Female. (*a*) Lateral ×140. (*b*) Posterior maxilliped ×265. (*c*) Posterior antenna ×265.

♀ Genital segment longer than the rest of the abdomen, the following segments broader than long; furca shorter than the fifth abdominal segment, less than twice as long as broad, innermost terminal bristle shorter than the outermost. Posterior antennae retrograded; terminal hook of posterior maxillipeds, and the distal bristles of the second basal provided with spines. Outer ramus of swimming feet narrow, end joint of inner ramus even in the fourth with terminal processes and smooth proximal outer marginal bristle.

♂ Unknown (?)

Coloration: Reddish throughout body; eggs red.

Length: Female, 0.46-0.5 mm.

Occurence: Rather uncommon; a few come during the summer.

Fam. Corycaeidae.

Corycaeidae Giesbrecht, 1892, p. 83.

Paired eyes highly developed in both sexes or in females, with large cuticular lenses and pigment bodies.

♀ The broad front and the two chitin lenses, sometimes contiguous and sometimes separated, are characteristic of the body form (fig. 57*b*; 62.). Anterior portion of the body may be conical (*Corycaeus* fig. 62) or cubical (*Copilia*) or oval and depressed (*Sapphirina* fig. 58*a, b;* 59*a*. *Corina*). The number of segments may be 10 (*Sapphirina*), 8 (*Corina, Copilia*) or 7 to 4 (*Corycaeus*); each part of the furca with only four or five bristles. Anterior antennae 3- to 6-jointed, posterior antennae (fig. 58*c*) with at least a heavy terminal hook; mandibles reduced to blade; maxillae oval or elongate platelets, with 3 to 5 bristles; anterior maxillipeds as in the *Oncaeidae*, posterior 3-jointed, terminal hook strong. Rami of swimming feet 3-jointed, except in the case of the inner ramus of the fourth pair, which shows all transitions from the 3-jointed ramus to a rudiment consisting of a single bristle.

♂ Sexual peculiarities in form of body and posterior maxillipeds, also in the other appendages and more striking than in the *Oncaeidae*.

1. Genus **Sapphirina** J. V. Thompson.

Sapphirina J. V. Thompson, 1829.
Sapphirina Templeton, 1836.
Sapphirina Dana, 1848, p. 41; 1849, p. 281; 1852, p. 1234.
Sapphirina Claus, 1863, p. 149.
Sapphirina Haeckel, 1864, p. 102.
Sapphirina Brady, 1883, p. 121.
Sapphirina Giesbrecht, 1892, pp. 84, 618, 761.
Sapphirina Wheeler, 1899, p. 190.

Body depressed; anterior and posterior portions of body with 5 segments in the female, middle abdominal segments broadened. Furca leaf-like, with five bristles. Rami of feet broad, in first, second, and third pairs about equal in length; inner ramus of fourth pair with 3 joints, of varying relative size; fifth pair of feet with two bristles. Male with leaf-like broadened segments in trunk, iridescent; no general sexual peculiarities in mouth parts and swimming feet.

♀ Eye lenses contiguous or close together. Genital orifice placed far at the side of the segment. Anterior antennae 3- to 5-jointed, posterior antennae (fig. 58*c*) with a short hooked bristle on the terminal joint and slender bristles elsewhere. The terminal joint of the anterior maxillipeds is drawn out into a long spine; hook at end of posterior maxillipeds short and thick. Outer rami of swimming feet with broad-edged, lancet-shaped outer marginal bristles; in the first to third pairs the first, second, and third joints have respectively one, one, three bristles; in the fourth pair, one, one, two (three). The first, second and third joints of the inner ramus of the first foot have respectively one, one, six bristles; of the second foot one, two, six; of the third one, two, five, and of the fourth one, two, two, (one).

♂ Abdomen with five segments; genital valves broad but short, with several bristles; hooks at end of posterior maxillipeds elongated, and articulating with the second basal by means of an intervening joint (fig. 60*a*).

1. **Sapphirina iris** Dana.

Sapphirina iris Dana, 1849, p. 41; 1852, p. 1239; 1855, pl. 87, figs. 1 *a-d*.
Sapphirina salpae Claus, 1863, p. 152.
Sapphirina gemma Brady, 1883, p. 127; pl. 48, fig. 6-8.
Sapphirina salpae Giesbrecht, 1892, pp. 618, 641; pl. 2, fig. 9; pl. 52, figs. 1, 2, 18, 19, 27, 45, 51; pl. 53, figs. 7, 23, 24, 60; pl. 54, figs. 9, 13, 15, 16, 19, 57.
Sapphirina iris, Giesbrecht, 1895, p. 261.

♀ Furca more than 2⅓ times as long as broad, inner border more convex than outer, a small point at end of inner margin (fig. 57*c*); the dorsal bristle is placed farther back than those on the outer border. Anterior antennae 5-jointed, 6/7 as long as the posterior; second joint 1⅓ times as long as the three terminal joints. Inner ramus of posterior antennae about ⅘ the length of the second basal, end hook half as long as the second joint of the inner ramus. Inner ramus of fourth foot little shorter than the outer, third joint of latter with 3 outer marginal bristles. Third joint of inner ramus not much shorter than the other two together, with two bristles on the end.

♂ Body about 2½ times as long as its greatest width (fig. 57*a*). Eye lenses ventral, overhung by the margin of the front of the head. Furca, anterior antennae, fourth pair of feet like same parts in the female, posterior antennae, mandible, maxilla,

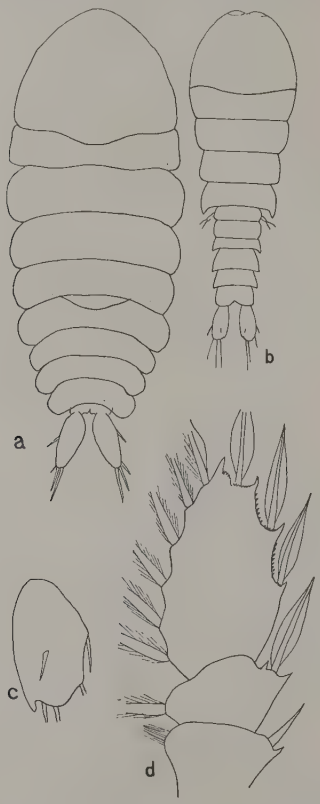

Fig. 57.—*Sapphirina iris.* (*a*) Male, dorsal, ×9. (*b*) Female, dorsal, ×9. (*c*) One ramus of furca of female, dorsal, ×83. (*d*) Outer ramus of fourth foot of male ×140.

anterior maxillipeds somewhat different; terminal joint of inner ramus of second pair with 3 lancet-like bristles.

Coloration: Egg cases red; body rather transparent and strikingly iridescent in the male.

Length: Female, 5-7 mm.; male, 7-8 mm.

Occurrence: Both sexes are rather common, in winter and summer collections.

2. **Sapphirina angusta** Dana.

Sapphirina angusta Dana, 1849, p. 41; 1852, p. 1240; 1855, pl. 87, figs. 3*a*, *b*.
Sapphirina danae Lubbock, 1856, p. 33, pl. 12, figs. 9-11.
Sapphirina clausii Haeckel, 1864, p. 104, pl. 2, figs. 21-25.
Sapphirina angusta Giesbrecht, 1892, pp. 619, 641; pl. 52, figs. 5, 6, 53, 58, 66; pl. 53, figs. 6, 17, 29, 30; pl. 54, figs. 2, 8, 17, 20, 60, 61.

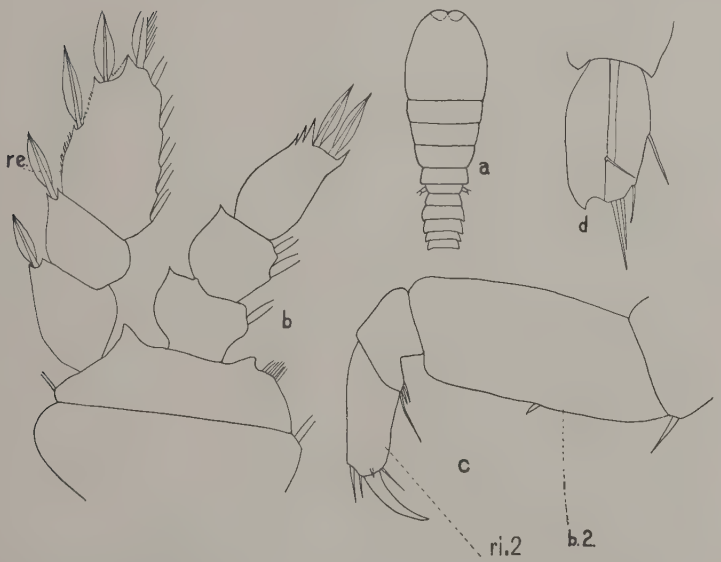

Fig. 58.—*Sapphirina angusta*. (*a*) Female, dorsal, furca not shown, ×14. (*b*) Fourth foot of female ×160. *Re.*, outer ramus. (*c*) Posterior antenna, female, ×160. *B.*2, second basal joint. *Ri.*2, second joint of inner ramus. (*d*) Furca of male, dorsal, ×60.

♀ Head longer than broad; furca almost twice as long as broad, with a broad tooth at end of inner border (fig. 58*d*), dorsal bristle placed farther back than the outer marginal bristles. Anterior antennae 5-jointed, 5/6 as long as the posterior, second joint 5/4 as long as the 3 terminal joints together. Inner ramus

of posterior antennae 5/7 as long as the second basal joint terminal hook 2/3 as long as the second joint of the inner ramus (fig. 58*c*). Inner ramus of fourth foot little shorter than the outer; terminal joint of inner ramus about 3/4 the length of the first and second joints together, with two bristles on the end (fig. 58*b*).

♂ Length of trunk 2¼ as much as its greatest diameter. Eye lenses as in *iris*. Furca, fourth pair of feet, anterior antennae as in the female, the other appendages somewhat different; terminal joint of inner ramus of second foot with 3 lancet bristles and elongated teeth.

Coloration: Egg cases blue, otherwise as *S. iris*; the males are brilliantly iridescent.

Length: Female, 2.5-5 mm; male, 3-5 mm.

Occurrence: Both sexes occur frequently in summer and winter.

3. **Sapphirina scarlata** Giesbrecht.

Sapphirina scarlata Giesbrecht, 1892, p. 642; pl. 52, figs. 42, 60, 61; pl. 53, figs. 12, 39; pl. 54, figs. 25, 31, 72.

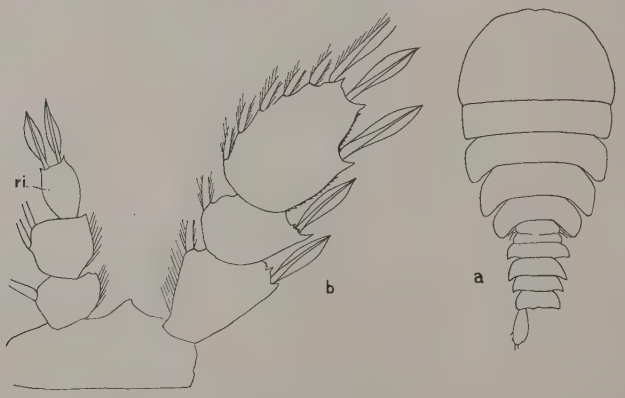

Fig. 59.—*Sapphirina scarlata.* Female. (*a*) Dorsal, ×18. (*b*) Fourth foot, ×140. *Ri.*, inner ramus.

♀ Head broad, furca hardly twice as long as wide; inner marginal bristle placed a little farther forward than the outer marginal. Anterior antennae 5-jointed, not half as long as the posterior, second joint 1¼ times as long as the terminal joint.

Inner ramus of posterior antennae longer than the second basal; terminal hook half as long as second joint of inner ramus. Inner ramus of fourth foot half as long as the outer (fig. 59*b*), terminal joint of inner ramus as long as first or second joints, with two bristles at the end.

♂ Length of trunk not quite twice its greatest breadth, eye lenses set back almost on the margin of the front. Furca, antennae and anterior mouth parts as in the female; terminal joint of outer ramus of second foot with two lancet bristles, the three thick, awl-shaped teeth elongated.

Coloration: Transparent, with bright red spots on the thorax and abdomen.

Length: Female, 3.3 mm.

Occurrence: One adult female was taken; immature specimens have come in at other times.

4. **Sapphirina lomae** n.sp.

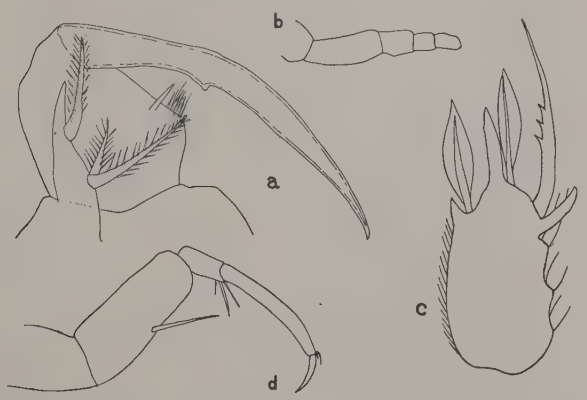

Fig. 60.—*Sapphirina lomae, n. sp.* Male. (*a*) Posterior maxilliped ×83. (*b*) Anterior antenna, bristles omitted, ×83. (*c*) Third joint of inner ramus of second foot ×195. (*d*) Posterior antenna ×83.

Resembling *S. nigromaculata* in general; anterior antennae (fig. 60*b*) nearly half as long (7/16) as posterior and 5-jointed; second joint shorter than the three terminal joints together. Inner ramus of posterior antennae (fig. 60*d*) nearly half again

as long as the second basal, terminal hook not 1/5 as long as the second joint of the inner ramus. Inner ramus of fourth foot not ½ as long as the outer ramus, third joint of former with two terminal bristles; third joint of inner ramus of second foot (fig. 60*c*) with 2 lancet bristles, the third notched on one side; projections on margin of joint much elongated.

S. lomae differs from *S. nigromaculata* most in the relative lengths of the joints of the posterior antennae and in the form of the toothed bristles on the terminal joint of the inner ramus of the second foot. Two males were taken on May 31, 1904, but are so badly mutilated that it is impossible to make a drawing of the entire animal.

Length: 3.2 mm.

Occurrence: San Diego, May 31, 1904, 2 males.

Note.—The species of *Sapphirina* are separated into two general groups, according as the inner ramus of the fourth foot is very small and narrow (fig. 59*b*), compared with the outer ramus, or at least ⅔ as long as the outer. *S. iris* and *S. angusta* belong in the latter group, and *S. scarlata* and *S. lomae* in the former. *S. iris* is distinct from any other species in having 3 bristles on the outer margin of the third joint of the outer ramus of the fourth foot; *S. angusta* may be recognized by the shape of the furcal rami.

2. Genus **Corycaeus** Dana.

Corycaeus Dana, 1848, p. 35; 1849, p. 280; 1852, p. 1203.
Corycaeus Lubbock, 1856, p. 32; 1857, p. 409; 1860, p. 182.
Corycaeus Claus, 1863, p. 154.
Corycaeus Giesbrecht, 1891, p. 480; 1892, pp. 85, 659, 735.
Corycaeus Dahl, 1894*b*, p. 67.
Corycaeus Wheeler, 1899, p. 191.

♀ Eye lenses close together, in some cases contiguous; fifth thoracic segment very short. Anterior antennae 6-jointed, bristles not plumose; second basal of posterior antennae large, first basal very short, each provided with a long, heavy bristle, inner ramus with a thick, strongly curved hooked bristle. Terminal joint of anterior maxilliped ends in a strong hook; second basal of posterior maxilliped with one bristle on the inner margin, terminal hook more slender than in *Sapphirina*. Outer ramus of swimming feet longer than inner rami; outer marginal bristles of outer ramus in first and second pairs are lanceolate and dentate, and are more or less suppressed in the third and fourth pairs.

♂ Lips of genital orifice long, with one bristle; the posterior antenna and maxilliped show distinct differences, especially in the elongation of the terminal hook.

The genus may be readily recognized by the cylindrical shape of the body, with the eye lenses at the anterior end.

1. **Corycaeus venustus** Dana.

Corycaeus venustus Dana, 1849, p. 280; 1852, p. 1222, pl. 86, fig. 4*a*.
Corycaeus limbatus Brady, 1883, p. 114, pl. 49, figs. 18-22.
Corycaeus venustus Giesbrecht, 1892, pp. 659, 674, pl. 51, figs. 32, 33, 34, 47.

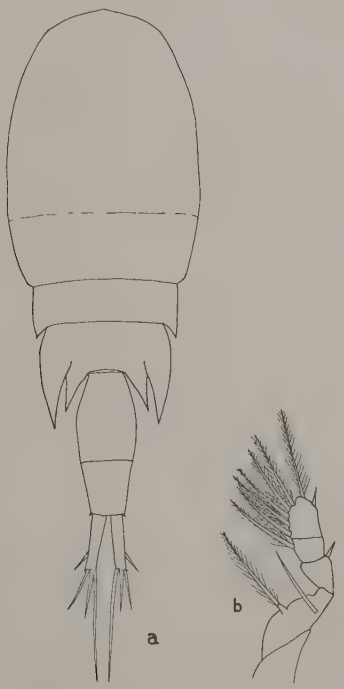

Fig. 61.—*Corycaeus venustus.* (*a*) Female, dorsal, ×83. (*b*) Fourth foot, female, ×140.

♀ Cephalothorax with 4 segments, abdomen with 2, ventral keel rounded, furca almost 5 times as long as broad (Genital segment: anal segment: furca:: 3:2:2).

♂ Genital segment about ¾ as long as the anal segment and furca together.

Coloration: Varying amounts of red or yellow red pigment in mouth region, posterior thoracic segments, and genital segment; eye red.

Length: Female, 0.8-1 mm.; male, not over 0.8 mm.

Occurrence: A few were taken June 16, 1904.

2. **Corycaeus carinatus** Giesbrecht.

Corycaeus carinatus Giesbrecht, 1892, pp. 661, 675; pl. 51, figs. 20, 26.

Corycaeus carinatus Wheeler, 1899, p. 192, fig. 30.

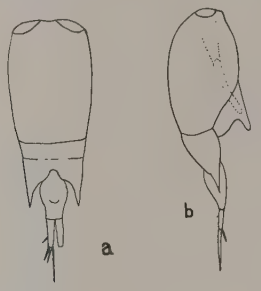

Fig. 62.—*Corycaeus carinatus.* (*a*) Female, dorsal, ×40. (*b*) Female, lateral, ×40.

♀ Cephalothorax with 2 segments, abdomen with 1; ventral keel beak-like and pointing back; the abdomen tapers toward the posterior end, furca half as long as the rest of the abdomen, about 4 times as long as broad.

♂ Unknown.

Coloration: Red or yellowish red pigment in region of mouth, extensions of thoracic segments, and in the genital segment; eye red.

Length: 0.86 mm. to 0.92 mm.

Occurrence: A few specimens taken at San Diego, Dec. 30, 1903, and Jan. 4, 1904.

Cambridge, Mass.,
January 4, 1905.

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